Edward B. Rowe

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OF THE

PRESIDENT AND TREASURER

PRESENTED AT THE DECEMBER MEETING OF THE CORPORATION

JANUARY, 1911


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Report of the President.

TO THE MEMBERS OF THE CORPORATION:

I have the honor to present reports from various officers of the Institute on the working of their departments during the preceding year.

THE CORPORATION.

During the year the Corporation has suffered the loss of six of its members. The term for which Messrs. Frederick K. Copeland, Joseph P. Gray and Frank L. Locke were elected expired in March. The other losses were due to the resignations of Messrs. Charles J. Paine and Charles F. Choate and the death of Charles Fairchild. All these members rendered valuable service to the Institute and interested themselves in the development of various departments. General Paine was specially active in advancing the interests of the Department of Naval Architecture. It is largely through his liberality that the equipment of the Department—including instruments, apparatus and models—has been placed in the front rank. In the place of the members whose term has expired the Corporation has welcomed Messrs. Edward Cunningham, Frank W. Rollins, and Edwin S. Webster. The three vacancies amongst the life members have not yet been filled.

THE FACULTY.

During the year the Faculty has lost the services of Professor John Bigelow, Jr., through resignation, and his

place as Professor of French has been filled by the appointment of Professor Ernest F. Langley. Professor Langley graduated from the University of Toronto, and, after studying abroad, returned to this country to receive the degree of Ph.D. from Harvard and gain experience as a teacher on the Faculty of Dartmouth College, from which he came to us with the highest recommendation. The professorship of Military Science was vacated in October by Captain Alpha T. Easton, who during the year in which he was at the Institute proved himself unusually capable in dealing with the problems with which such an officer is confronted. His place has been filled by the appointment of Captain Edwin V. Bookmiller. Owing to the rapid expansion of the Department of Industrial Chemistry, it has been necessary to increase the staff by the establishment of a new professorship. This position has been filled by the appointment of Dr. Warren K. Lewis, a graduate of the Institute, who was formerly on its Instructing Staff and has had considerable experience in the industrial world. The following promotions have been made within the Faculty: Associate Professor Charles L. Norton has been advanced to the grade of full professor; Assistant Professors F. Jewett Moore, Charles B. Breed, George B. Haven, and William J. Drisko to that of associate professors; and Instructors Ellwood B. Spear, Theodore H. Taft, Daniel F. Comstock, and Research Associate William C. Bray to that of assistant professor.

THE UNDERGRADUATES.

The number of undergraduates continues to increase in a normal manner, and their distribution with regard to states and foreign countries maintains the reputation of the Institute as one of the most cosmopolitan institutions in the world. The number of foreigners at the Insti-

tute today is one hundred and two, representing thirty-six foreign countries. In addition to this there are students from practically every state in the Union and its territories. This cosmopolitan character is sometimes made the subject of criticism on the ground that Massachusetts should be mainly concerned with the education of her own sons. It is, of course, unnecessary to remind your Corporation that this view of the matter is a narrow one and that the prosperity of the state is intimately bound up with that of other states and with the rest of the world. Apart from this broad aspect of the matter, there is a clear direct gain to Massachusetts in having representatives of so many states and nations educated together within its borders. These are picked young men who carry a knowledge of this state and something of its ideals to every quarter of the globe. Moreover, the opportunity thus presented to the youth of Massachusetts to mix with a cosmopolitan set is immensely to their advantage. It would, indeed, be extremely unfortunate if any circumstances should arise through which the Institute should cease to attract from far as well as from near. If it cannot keep its reputation so high that in spite of high fees it continues to draw men from all quarters of the Union and from abroad, then the education that it gives cannot be good enough for Massachusetts, a state to which a highly advanced system of technical education is more vital than to almost any other.

It is interesting to observe the continued increase in the number of men who come to the Institute from other colleges. There are four hundred and five such men here today, constituting twenty-seven per cent. of the whole student body. They come from more than one hundred colleges scattered throughout most of the states of the Union and several foreign countries. Two hundred and fifteen of these men are graduates of the colleges from which they came, the remaining one hundred and ninety having

come to the Institute before graduation. These men form a welcome addition to our student body, giving it variety and breadth, even although on the average they may not be so good on the side of scholarship as our more regular students. Unfortunately the large increase in this class of students relative to the whole group imposes an additional financial burden on the Institute. The majority of them come for the work of the higher years, which is more technical in character and consequently more expensive to maintain than that of the Freshman and Sophomore years. It may be noted that the building up of this "graduate school" has gone on steadily without any special effort on the part of the Institute to encourage it. Ten years ago there were ninety-one graduates of other institutions here; now, as has just been pointed out, there are two hundred and fifteen graduates in addition to the one hundred and ninety, most of whom have spent at least two years in colleges before entering this Institute. No difficulty whatever is experienced in carrying on the instruction of these men along with that of the regular students. The supposition that the college men are more broadly trained does not bear examination except in unusual cases. This Institute has always made a serious effort to combine liberal and professional studies, and on the side of breadth the work of its students in their earlier years will compare favorably with that of most institutions of the better type. In this connection I would direct your attention to the interesting graphical representation of the time alloted to various studies in our different courses. This representation is contained in the report of the Registrar, and its production is another example of his devotion to the service of the Institute and his willingness to spend time and energy even on matters that lie entirely outside his regular duties.

Another unusual feature of the Registrar's report is

the scholarship record of men from various preparatory schools during their career at the Institute. The report covers a period of twelve years and sets forth the number of students entered from different schools in Boston and its neighborhood, the percentage that have graduated, the percentage that have failed,—failure here meaning either that a student has failed to graduate, or that he or she has left with a poor record. It also sets forth the average standing of the students who graduated and their average standing during their first year at the Institute. The results of this investigation will be unexpected to some, particularly as regards the record of students from the Mechanic Arts High School. It has sometimes been thought that this school forms the natural avenue to the Institute; and yet these records show that, on the average, students from this school show a smaller percentage of graduates, a much larger percentage of failures, and a somewhat poorer average standing than do students from most of the other schools referred to. It should, of course, be borne in mind that the record has reference to the average and that although this average is unsatisfactory for the Mechanic Arts High School some of the very best students at the Institute have come from that school. Further it should be remembered that the difference between the schools may be due to differences of quality in the materials that they receive as well as to differences in the mode of treatment of that material. It would be interesting to follow the matter up, but its treatment to be fair would be somewhat lengthy and perhaps somewhat out of place in this report. I therefore content myself with directing your attention to the simple record of facts as set forth by the Registrar.

As does the number of students continue to be satisfactory, so there is no falling off in quality. Their health continues excellent and their spirit admirable. No better antidote to pessimism could be recommended than to

get in close contact with such a body of young Americans. In the main they are men of ability, energy, and purpose, singularly free from sordid ambitions and anxious to do the best not only for themselves, but for their fellows. It is an encouraging study to trace the growth within recent years of student government at the Institute. This government concerns itself with athletics and with that great variety of interests grouped under the unfortunate title of "student activities." As regards athletics, the government is in the hands of a Council composed of three undergraduates and four alumni without any representatives from the Faculty. This Council has been conspicuously successful in establishing a sane athletic policy, aiming to make athletics a healthful exercise rather than an absorbing business. It encourages an active participation in manly sports by the whole student body rather than the development of exceptional skill by a few. It prefers competitions between individuals or teams within the Institute to frequent contests with other institutions, thereby avoiding such fevers of excitement as sweep over many of our colleges and tend to demoralize the entire student body. This athletic policy has been established by the undergraduates in coöperation with former students of the Institute; but the rules that have been developed to control the other "activities" are due in even larger measure to undergraduate initiation. Two years ago the Acting President directed your attention in his annual report to the establishment of the "point system," a system designed to eliminate one of the most serious faults in societies of students,—the undue loading of certain individuals with duties and honors. The system here initiated has been used as a model for similar schemes that have been adopted by various educational institutions throughout the country. In 1893 the undergraduates set up what is known as the Institute Committee, a committee that is regarded as the official representative of

the entire student body. Its aim is to promote in all matters the welfare of the students, but for long it could work towards this end only by resolutions and petitions. In process of time it came to be recognized by the students here, as by more august assemblies elsewhere, that legislation to be effective must be associated with the power of the purse. During this year there has therefore been established a Finance Commission, composed of the President of the Institute Committee and two alumni. The power and expected effectiveness of this Commission are thus set forth by one of our graduates:—"The Finance Commission will have the power to insist upon a clear, business-like financial report being presented monthly by each activity. If the financial condition of any activity is such that, in the opinion of the Finance Commission the activity will not be able to pay any debt incurred, the Finance Commission will have power to insist upon some guarantee from the activity that the amount to cover such indebtedness be raised. The results that this plan is expected to accomplish are chiefly three: *first*, by insisting on clear monthly reports, and the proper methods of accounting necessary for them, it will allow every manager to know definitely at all times just where he stands instead of being willing to rely on guesses, as has been too often the case; *second*, by demanding in advance a guarantee of payment of debts, where a deficit is foreseen, it will prevent any recurrence of non-payment of debts, and thus give much needed protection to the good name of the Institute; and, *third*, by giving the students the advice and oversight of experienced business men, it will make the business training obtained through management of student activities always of real value instead of being often a positive influence for bad."

THE ALUMNI.

During the year important contributions to pure science have been made by the senior members of the alumni body. In addition to this much promising work is being done by the younger men under the stimulus of the research laboratories of the Institute. In the field of applied science the contributions of the alumni to the development of commerce and industry gain every year in volume and importance. These alumni are now to be found in every state of the Union, either developing mines, making bridges, laying out and managing street railroads, advancing chemical industries, designing buildings, expanding commerce, or in other ways increasing the national wealth and well-being. Not a few are employed directly in the service of states or cities, and the number engaged in such work should increase as the conditions of service improve and as the need of technically trained men for such work is more generally recognized. Our cities particularly have suffered far too much in the past by having engineering work controlled by men who know little or nothing of engineering.

The direct representation of the alumni in the governing body continues to prove a source of strength to the Institute. Some changes in the mode of election of these representatives have been made during the year, and it is hoped that these changes will prove satisfactory to the alumni body and will remove some of the difficulties of selection with which your Corporation has occasionally been confronted.

This year has brought to an end the contribution towards the general expenses of the Institute that has been received for the last five years from what is known as the Alumni Fund. This support has been invaluable to the Institute; indeed, without it it would have been impossible to maintain the high standards of efficiency and excellence that

the traditions of the Institute demand. The sum contributed has been $206,665; and its contribution has been a really remarkable achievement when the youthfulness of the average alumni is taken into account. Today there are only about three hundred men living who had been graduated for twenty years when the Alumni Fund was set up. The contribution of over two hundred thousand dollars when there were so small a number of men who could be in a position to help largely gives some indication of the great assistance that may be expected in the future, when the large number of men who now leave the Institute yearly have had time to mature. The number graduated for more than twenty years has already more than doubled since the Alumni Fund was established and in another five years it should be quadrupled.

COURSES OF INSTRUCTION.

Within the year there have been numerous modifications of the courses of instruction, but the only matter calling for special comment in this report is the change with regard to modern languages. The policy in the past has been to require every student to devote a considerable portion of his time to the study of *both* French and German. The result, however, has not proved completely satisfactory, owing mainly to the fact that the teaching of modern languages in the preparatory schools is not yet sufficiently developed to meet the needs of this counsel of perfection. Men do not enter well enough prepared to get a real working knowledge of both French and German in the time that can be allotted in a four years' course. After a careful scrutiny of the whole situation and with the aid of valuable suggestions from the Visiting Committee of the Corporation, the Faculty adopted the modifications that are set forth in the report of Professor Vogel. The broad result of the changes is to concentrate effort on one lan-

guage, on the theory that it is better to do one thing well than two indifferently. In practice the new rules mean concentration on German for all departments except that of Architecture, where German is replaced by French. It is still open to any student to take both languages, one as an option, and as heretofore Spanish and Italian are offered for the benefit of those who wish to extend their knowledge of the Romance languages.

A change that has not yet been effected but which has engaged the attention of the Faculty and of the Executive Committee has reference to the establishment of a course or courses that would prepare men more definitely for administrative positions in the arts and industries. A scheme for some such course was drawn up nearly ten years ago, and since then schools of business administration have been established in various parts of the country. It is felt by those who favor the change that there are special reasons for such work being connected with a school of applied science, partly because the method and the spirit of science form the basis of success in many important businesses, and partly because so large a share of modern business is concerned with the applications of science to industrial problems. There is a large and important field of work of this character that might be occupied by the Institute without encroaching on what is being done elsewhere in this community, and the occupation of this field would help to round out the system of education offered by the Institute.

RESEARCH.

It is recognized by all who have studied the problem seriously that the spirit of research is vital to the success of a great scientific school. The Institute has been fortunate from the first in having connected with it a considerable number of men deeply imbued with this spirit, and it is encouraging to observe that an increasing number

of able young men are being attracted to this field. The influence of such men is all for good and, in such an institution as this, there is no danger of the research element unduly predominating and making the courses too academic or too remote from the pressing practical needs of the day. It is particularly gratifying to notice that we continue to retain the services of men of the front rank in pure science, a fact that has been emphasized by an impartial witness in a recent survey of American men of science. In the field of research, of course, it is quality and not quantity that is all-important. I have little sympathy with the elaborate efforts that are made in some places to turn out a great volume of research. The second rate work might easily be dispensed with, although the first rate is beyond price, and it goes without saying that to have first rate work we must have first rate men. It should be pointed out that most of the research work that is done here is conducted without imposing any serious financial burden on the Institute, and that this has been possible because of the support of various generous friends. In the field of pure science the most important research work is being done under the stimulus of the Research Laboratory of Physical Chemistry, the expense of the investigations being defrayed in part by the Director and in part from grants made to him by the Carnegie Institution at Washington. There are nine men working regularly in this Laboratory, and it is partly through their influence that amongst the various institutions of learning in this country "the Massachusetts Institute of Technology stands clearly first in chemistry," according to the authority that has just been referred to. In applied science the Research Laboratory of Applied Chemistry is one of growing importance to the Institute. The work done here has been supported by generous donations from a member of the Corporation, as well as by funds that come to it in return for services rendered

from those who have given it problems for solution. Its work should grow in importance and influence as the value of such research gains increasing recognition from the mercantile community and as the Institute trains an increasing number of men to advance the chemical industries of the country. The number is already rising rapidly, the most notable increase during the year in any department at the Institute being that of over fifty per cent. in the number of students following the course on Chemical Engineering. The Sanitary Research Laboratory has been maintained for the last eight years mainly by the generosity of an anonymous donor. It has done and continues to do work of vital importance for the public health. Through the influence of its Director and those whom he has inspired the Institute has taken a lead in investigating in a scientific way some of the fundamental problems of sanitation and has supplied a large number of men who are now scattered throughout the length and breadth of the land administering departments of public health and in other ways improving the physical well-being of the community. It is a field in which much yet remains to be done if the practice in this country is to be brought up to the level of the best practice abroad, and much more if the possibilities of further advancement are to receive the consideration that they deserve. Within the last year there has come to the Institute from the trustees of the estates of Caroline Whitney and Edward Whitney the sum of $25,000 for the promotion of research in the field of seismology. It is hoped that with the aid of this fund work of importance may be carried out that will tend to the advancement of science and the protection of society against the evils that accompany earthquakes. In many other directions it is recognized that there is room for the conduct of research, particularly in the fields of electrical and mechanical engineering; but here, as elsewhere, the Institute is hampered in its development through lack of space and lack of funds.

THE SOCIETY OF ARTS.

The Society of Arts has just held its six hundred and seventy-first meeting. Its history has been a record of valuable work in the dissemination of a knowledge of science and its applications. The list of members has contained and still continues to contain the names of many eminent men in the community, and the Society has still the opportunity of hearing important scientific matters handled by masters of the subjects with which they deal. However, as was pointed out in my last report, there are many forces at work in the community that are detrimental to the success of a mere lecture society, and it is felt that special efforts must be made to meet the changed conditions of the times, if the Society is to continue to be the force that it formerly was. Some of the members who have served the Society with great devotion for many years have retired from the Executive Committee and their places have been taken by Mr. Theodore N. Vail, Professor Elihu Thomson, Mr. James P. Munroe, Mr. Frederic H. Fay, and Professor Carroll W. Doten. Under the new régime it has been decided to give greater prominence to the publications of the Society. The scope of the *Bulletin* has been enlarged so as to form a periodical with the title of *Science Conspectus*. This is to be published in December, January, February, March and April, and sent to each member of the Society. Its aim is to present new developments in science, whether pure or applied, in a form that will be attractive to the man of intelligence, whether he be a scientific specialist or not. The publication will be under the editorship of Mr. I. W. Litchfield, who brings great enthusiasm to the task. He will have the assistance of a Board of Publication, composed of some of the ablest and most energetic men amongst the younger element in the Institute's instructing staff.

FIFTIETH ANNIVERSARY.

On the 10th of April next it will be fifty years since the charter of the Institute granted by the Legislature was signed by Governor Andrew. The record of work accomplished in the half century that has elapsed has indeed been a remarkable one. The Institute has done pioneer work for education. Its methods and ideals have been carried into almost every quarter of the globe and into almost every phase of education. Its alumni have made important contributions to pure science, besides taking a large share in the work of applying scientific methods to the solution of the great practical problems of improving the health of the nation, opening up its territory, and developing almost every branch of its commerce and its industry. The impress that the Institute has made is all the more striking when we consider the small number of its students in the early days; and its great achievements under such conditions should inspire your Corporation with hope and confidence for its future. It does not seem proper that the fiftieth anniversary of its foundation should pass by without special comment. It has, therefore, seemed wise to the Executive Committee to adopt a suggestion made by the Alumni Council and celebrate this anniversary by holding a Congress of Technology on the 10th and 11th of April next. It is hoped that at this congress men of eminence will be present to set forth some of the broader results of the application of science to industry which it is the main purpose of this Institute to further and to indicate the gain in industrial efficiency that may be expected from the extension of its influence.

SOME PROBLEMS OF THE FUTURE.

In addition to the matters already touched upon in this report there are some problems of prime importance

that must be attacked in the immediate future. One of these is the problem of a site, a problem that has occupied a considerable portion of presidential reports for years. The urgency of an early solution of this problem certainly does not diminish as time goes on. A careful study of the reports from various departments must make it evident that in the crowded condition of the Institute today an early removal is inevitable. I regret that I am not able to report that the problem has been solved, but we are certainly much nearer a solution than we were a year ago and the prospect for an early settlement seems hopeful. Subsidiary to the problem of securing a new site is that of disposing of the old one. It seems probable that the Institute's property on Trinity Place can be disposed of advantageously in the not distant future and steps are being taken to make possible our removal from Boylston Street.

The site problem has occupied so much of your attention within recent years that it may have tended to overshadow all others. Its satisfactory solution is certainly important to the future well-being of the Institute, but more vital even than it is the problem of securing increased endowment. All expenses connected with the maintenance of leadership in our field of education tend steadily to rise. And yet, even as things are at present, and in spite of the most rigid economy, it is impossible with present resources to avoid a deficit without encroaching on the endowment fund that has been accumulated so carefully in past years. The deficit this year is $23,598.87 and there is a prospect of its being much greater next year, owing to the fact that the regular contributions from the Alumni Fund have ceased. To add further to the difficulties the contribution of $25,000 which has been received from the state for the last fifteen years comes to an end next year. Under these circumstances no effort must be spared by the friends of the Institute to secure a continuance—

and, if possible, an increase—of state aid. This is a question that affects the future of the Institute so vitally that I should enlarge on it further here, were it not that I have discussed the whole question somewhat fully in a document accompanying this report which is now in your hands.

Another matter of great importance that must be dealt with in the future is the extent to which the Institute of Technology should coöperate with neighboring institutions. This was a matter touched upon in the report of last year, when the need of conserving all our educational forces was referred to and the duty of coöperation whereever possible was set forth. The same need was admirably expressed by the Secretary of the Corporation in the *Technology Review* where he said, "It would be wise for the Institute to enlist all the higher educational forces of the Commonwealth in working out some plan through which, jointly, they may help Massachusetts to solve those perplexing problems of commercial growth and of industrial education which today confront her. Incidentally such a partnership would be of immense benefit to education itself, which suffers in few ways so much as through lack of coöperation among those colleges, universities, and schools of applied science which not only should be laboring together for the common good, not only should be avoiding by mutual agreement those duplications of resources and of effort that keep them all painfully poor, but also should be devising some plan by which students may be transferred from one to another without loss of time and effort, and may be brought thereby under those varied stimuli of environment and teaching so beneficial to ambitious youth." Somewhat definite schemes for coöperation with Harvard and with Boston University have been suggested during the year and some of the suggestions received the earnest attention of the Executive Committee. No large scheme of coöperation can be carried through with any hope of its permanence while the

MASSACHUSETTS
INSTITUTE OF TECHNOLOGY

GRAPHICAL COURSE SCHEMES

AS TAKEN BY THE

CLASS OF 1910

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1910

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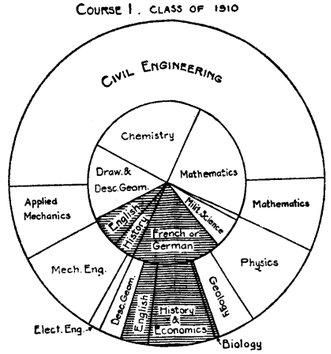

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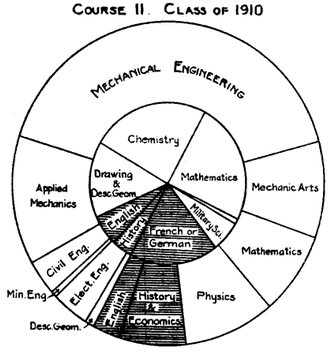
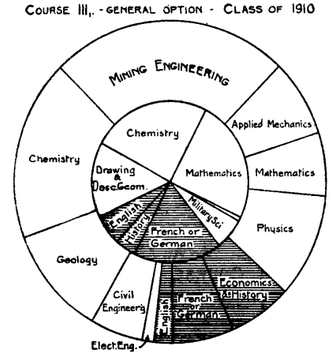
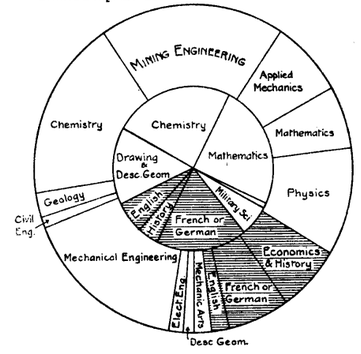


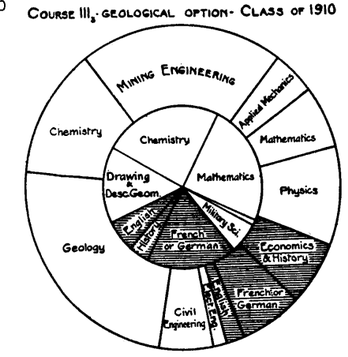
COURSE III₁ - GENERAL OPTION - CLASS OF 1910



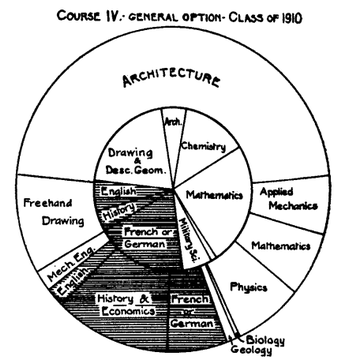
COURSE III₂ METALLURGICAL OPTION - CLASS OF 1910



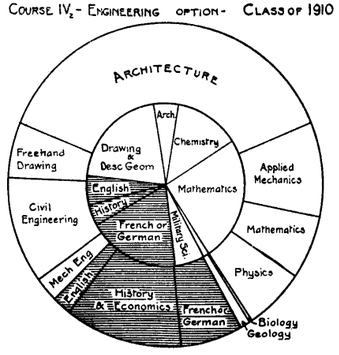
COURSE III₃ GEOLOGICAL OPTION - CLASS OF 1910



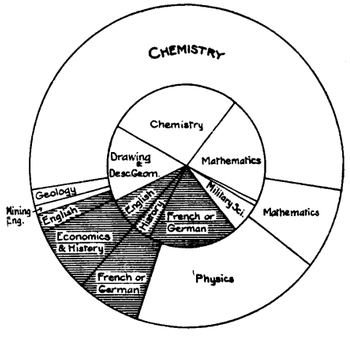
COURSE IV. GENERAL OPTION - CLASS OF 1910



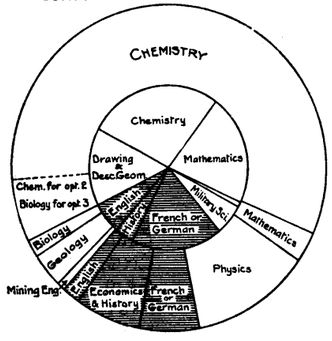
COURSE IV₂ - ENGINEERING OPTION - CLASS OF 1910



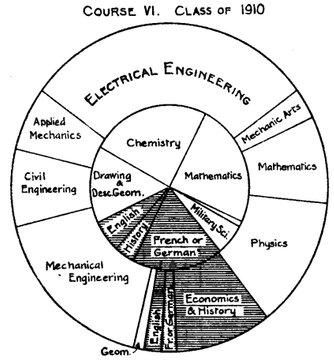
COURSE V₁ PHYSICAL CHEMISTRY OPTION CLASS OF 1910



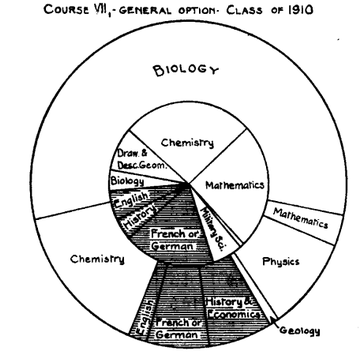
COURSE V. - OPTIONS 2 & 3 - CLASS OF 1910



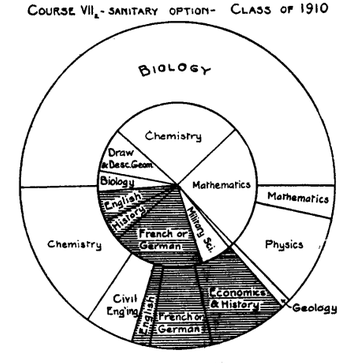
COURSE VI. CLASS OF 1910



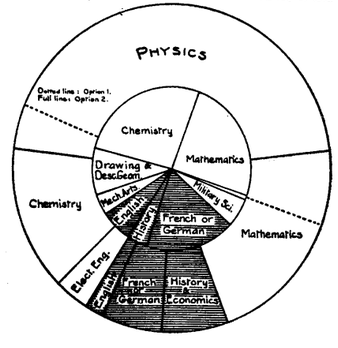
COURSE VII₁ - GENERAL OPTION - CLASS OF 1910



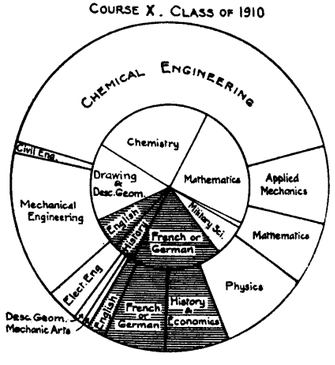
COURSE VII₂ - SANITARY OPTION - CLASS OF 1910



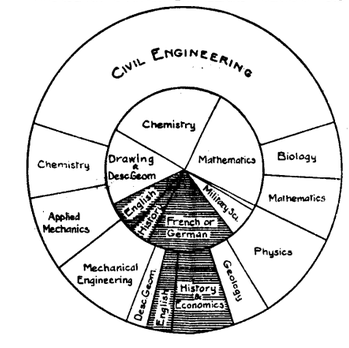
OPTIONS 1 & 2 - COURSE VIII CLASS OF 1910



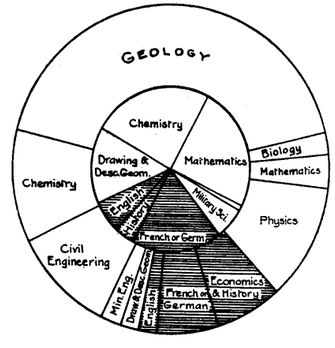
COURSE X. CLASS OF 1910



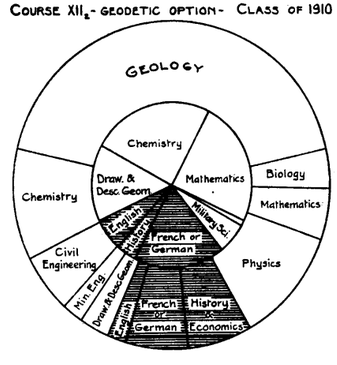
COURSE XI. - SANITARY ENGINEERING - CLASS OF 1910



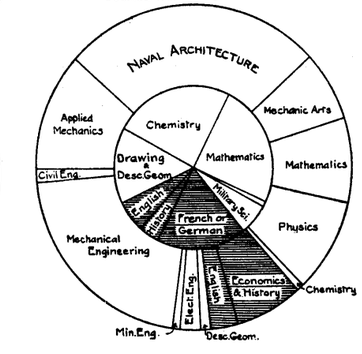
COURSE XII. - GEOLOGICAL OPTION - CLASS OF 1910



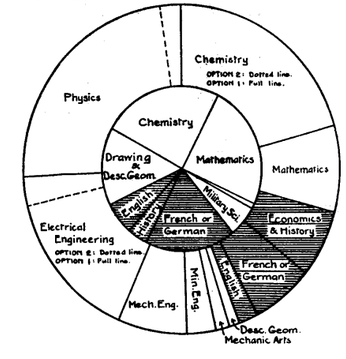
COURSE XII₂ - GEODETIC OPTION - CLASS OF 1910



COURSE XIII. - CLASS OF 1910.



COURSE XIV. - ELECTRO CHEMISTRY - CLASS OF 1910



GRAPHICAL COURSE SCHEMES
OF THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

The amount of time devoted to the subjects of the thirteen prescribed undergraduate Courses is here shown graphically:

In this scheme of graphical representation the area of the larger circle represents the 4760 hours of exercise and preparation of the four years. Because the schedules of all the Courses are the same for the first term of the first year, and so nearly alike in the second term, the time given to the first year is shown separately. The inner circle, one-quarter the area of the outer circle, represents the 1420 hours of the first year. The remaining three-quarters of the larger circle represents the hours of the second, third, and fourth years.

Each of these areas is divided into parts that are proportional to the time given to the subjects taught by the several departments of the school. The areas showing non-technical subjects are shaded. The unlabelled sector of the smaller circle is for Physical Training.

Massachusetts Institute of Technology

Per cent of time devoted to the subjects taught by the departments of the Institute in the course schemes of the Class of 1910.

The course scheme for each of the professional courses is for four years. Each year has two terms of 720 hours of exercise and preparation.

First Year	Math.	Draw.	M.A.	Eng.	Hist.	Lang.	Arch.	Chem.	Biol.	M.S.	P.T.
Courses I. II. III. VI. X. XI. XII. XIII. XIV.	24.5	15.3	-	6.1	4.1	18.4	-	24.5	-	6.1	1.0
Course IV.	24.8	20.6	-	6.1	4.1	18.6	5.2	13.4	-	6.2	1.0
" V.	21.4	15.3	-	6.1	4.1	18.4	-	27.5	-	6.1	1.0
" VII.	24.5	9.2	-	6.1	4.1	18.4	-	26.5	4.2	6.1	1.0
" VIII.	24.5	9.2	4.1	6.1	4.1	18.4	-	26.5	-	6.1	1.0

The Upper Three Years

Course	Math	A.M.	Draw.	M.A.	Eng	Hist.	Lang.	C.E.	M.E.	Min.	Arch.	Chem.	Elect	Biol.	Phys.	Geol	N.A.
I	7.0	7.3	2.4	-	2.8	7.0	-	50.0	9.0	-	-	-	1.4	0.4	9.0	3.8	-
II	8.3	13.0	1.0	9.7	2.8	6.9	-	3.5	41.0	0.7	-	-	3.8	-	9.3	-	-
III_1	6.3	7.7	-	-	1.9	6.5	6.3	5.6	-	24.7	-	18.4	1.4	-	10.4	11.1	-
III_2	6.3	7.7	1.0	1.7	1.9	6.5	6.3	1.0	16.8	18.7	-	17.7	1.4	-	10.5	2.4	-
III_3	6.3	4.5	-	-	1.9	6.5	6.3	5.6	-	20.8	-	12.9	1.4	-	9.8	24.1	-
IV_1	6.3	5.9	9.8	-	1.9	12.1	6.3	-	2.1	-	47.0	-	-	0.3	7.2	1.0	-
IV_2	6.3	9.3	5.6	-	1.9	12.1	6.3	10.8	2.5	-	31.8	-	-	0.3	6.2	1.0	-
V_1	8.1	-	-	-	1.9	6.5	6.3	-	-	0.8	-	54.7	-	-	19.5	1.7	-
V_2	3.1	-	-	-	1.9	6.5	6.3	-	-	0.8	-	64.1	-	1.7	12.2	3.5	-
V_3	3.1	-	-	-	1.9	6.5	6.3	-	-	0.8	-	57.8	-	8.0	12.2	3.5	-
VI	8.3	6.2	1.0	7.8	1.9	10.0	1.6	7.6	17.5	-	-	-	30.0	-	12.9	-	-
VII_1	3.1	-	-	-	1.9	6.5	6.3	-	-	-	-	15.3	-	56.7	9.2	1.0	-
VII_2	3.1	-	-	-	1.9	7.9	6.3	5.2	-	-	-	15.3	-	50.4	9.2	1.0	-
$VIII_1$	13.8	-	-	-	1.9	7.0	6.3	-	-	-	-	18.5	3.5	-	49.0	-	-
$VIII_2$	20.9	-	-	-	1.9	6.9	6.3	-	-	-	-	14.2	3.5	-	46.3	-	-
X	6.3	7.6	1.0	0.7	1.9	6.5	6.3	1.0	14.6	-	-	42.0	3.1	-	9.0	-	-
XI	6.3	7.3	2.1	-	2.5	6.5	-	40.9	8.7	-	-	7.3	-	5.6	9.0	3.8	-
XII_1	3.2	-	1.8	-	1.9	6.6	6.3	10.5	-	7.1	-	11.1	-	2.1	11.6	42.6	-
XII_2	5.0	-	3.2	-	1.9	6.6	6.3	5.8	-	7.1	-	10.9	-	3.9	11.4	42.9	-
XIII	8.3	11.9	1.0	6.9	2.8	6.9	-	1.4	21.3	0.7	-	0.7	2.1	-	9.3	-	26.6
XIV.	8.5	-	1.1	1.4	1.9	6.6	6.3	-	7.1	2.9	-	20.8	17.9	-	25.6	-	-
XIV_2	8.5	-	1.1	1.4	1.9	6.6	6.3	-	7.1	2.9	-	23.0	15.0	-	26.4	-	-

Explanation

A.M. Applied Mechanics
Arch. Architecture
Biol. Biology
Chem. Chemistry
C.E. Civil Engineering
Draw. Drawing & Desc. Geometry
Elect. Electrical Engineering
Eng. English
Geol. Geology
Hist. History & Economics
Lang. French or German
Math. Mathematics
M.E. Mechanical Engineering
M.A. Mechanic Arts
M.S. Military Science
Min. Mining Engineering
N.A. Naval Architecture
P.T. Physical Training
Phys Physics

Total hours for the four years = 4760

W.H. 1910

question of the future site of the Institute remains unsettled. In the meanwhile, however, it should be noticed that there has been considerable coöperation with different educational institutions in the past and that the amount of this coöperation is on the increase. A number of the assistants and instructors at the Institute are engaged in teaching at the Young Men's Christian Association, the Franklin Union, the Wells Memorial Institute, and the People's Institute. On a higher plane comes the work of assistants, instructors, and some of the professors in the Lowell Institute School for Industrial Foremen, an extremely important educational work that is carried on almost wholly by members of our staff. In the scheme of University Extension which has recently been adopted the Institute contributes not only lecture rooms and laboratories for the use of a number of the professors, but gives the services of several of its Faculty and some of their assistants. Professor Derr gives a course on Physics, Professors Smith and Wickenden courses on Applied Electricity, Professor Sumner a course on the History of Art and Civilization. More direct examples of coöperation are afforded by the lectures at this Institute given by Doctor Stiles, the head of the Biological Department at Simmons College. As an offset to this help from Simmons, Professor Sedgwick gives a course of one lecture a week and Professor Prescott one of five hours a week during the first half-year at Simmons College. During the present year Professor Despradelle gives regular lectures in Architectural Design at Harvard University. At the same University Dr. F. J. Moore gives a lecture course of two hours a week on Chemistry, Professor Dewey two lectures a week, during the first half of the year, on Money, Professor E. B. Wilson of the Department of Mathematics is to give a course on the Application of Probability in Theoretical Physics, and Professor G. N. Lewis a special course on The Principle of Relativity.

By special arrangement with the authorities of Harvard, the lectures of Professor Shimer on Paleontology are being attended by a number of students from Harvard; and next term a few of the students from the Institute are to take advanced courses in Physiography at Harvard. The coöperative spirit is evidently at work; how far it should lead us in the future is one of the larger problems that confront us.

RICHARD C. MACLAURIN.

Reports of Administrative Officers.

REPORT OF THE SECRETARY OF THE FACULTY.

During the last year the special committee appointed to consider the instruction in modern languages at the Institute presented its report from which the following extracts are taken:

"The Committee on Modern Language Instruction desires to report that it has conferred with professors in the Department, and has considered such information as is otherwise accessible concerning the instruction given and the results achieved in the language study at the Institute. Convinced of the great cultural, as well as practical importance of this study, the Committee feels that from a variety of causes the work at present accomplished is less satisfactory than might reasonably be expected."

The Faculty approved the following recommendations of this Committee as expressing its general policy:

1. That students receiving the degree of the Institute should have a fair knowledge of two foreign languages, which should in general be French and German; that they should be able to read at least one of these languages with facility; and that, in order to secure this result, instruction at the Institute should be concentrated on one language rather than be distributed between two, should be continued for at least a year and a half, and should include such final tests as will show conclusively whether individual students have reached the desired standard of proficiency.

2. That proficiency in reading rather than in speaking is the aim toward which instruction should be primarily directed.

In regard to entrance requirements the Committee makes the following statement:

"Since the amount of time which can be devoted to language study during the Institute course is not large, it is important that the requirement of two years of study in each language in preparatory schools be distinctly stated in the Catalogue, and that all practicable means be used in enforcing it upon the schools."

In regard to language study at the Institute they make the following statement:

"With reference to the required language study in the Institute, the Committee believes, after careful consideration, that the importance of a satisfactory accomplishment of the required work in modern language will be more effectively impressed upon students if the option between French and German, at present allowed in the first year, be discontinued, and the language required be made a specific one."

In view of this statement of the Committee the following recommendation was adopted by the Faculty:

"That students expecting to enter the course in Architecture be required to take French during their first year, and that all other regular students be required to take German; that any student having taken Intermediate French who enters some other Course than Course IV, or any student having taken Intermediate German who afterward enters Course IV be required to make up the intermediate language required in his new course unless excused by a special vote of the Faculty.

"In recommending German for all students other than those in the Department of Architecture the Committee has been influenced by three considerations. First, it believes that for most scientific men German is the more valuable of the two languages, opening up a larger and, in general, a more important current scientific literature. Second, the time and labor required to give the average

American student a working knowledge of German appears to be considerably greater than in the case of French. In the latter language two years of work in a preparatory school may be expected to give the pupil a fair reading ability, or, at any rate, to put such ability within easy reach if there shall subsequently be need or desire of acquiring it. The Committee does not believe that this would ordinarily be true of German, and therefore considers that for that language a more prolonged and thorough study is particularly important. Third, the mental training to be derived from the study of German (owing to its more complex structure) is in the opinion of the Committee greater than that to be derived from the study of French. The Committee further believes that a single year of German at the Institute is not sufficient to give the average student an adequate grasp of the language."

In view of the opinion of the Committee just expressed the Faculty approved their recommendations "that the professors in charge of the Courses in Chemistry, Biology, Physics, Chemical Engineering and Electro-Chemistry be requested to report as to the advisability of requiring students in these courses to continue German during their second year instead of taking French (this change has been made in all of these courses excepting Biology); also that as soon as opportunity occurs those courses in which only one year of language study at the Institute is at present required increase their requirement so as to provide for the continuation of study in the same language during the first term of the second year.

"In concluding this report the Committee wishes to express its confidence that the Department of Modern Languages can count upon the support of the Faculty in strictly enforcing its standards of punctuality and efficiency in the performance of all the required work."

The special committee appointed to consider the possible

revision of the Institute calendar presented its report, and the Faculty has adopted the following changes:

"In 1911 and thereafter the first term shall begin on the last Monday in September; in the school year of 1910 and after, the Christmas vacation shall be the calendar week in which Christmas occurs, except that when Christmas falls on Friday or Saturday the recess shall begin the preceding Thursday and extend through the following Wednesday, and when Christmas falls on Sunday the recess shall include also the Saturday preceding; the semi-annual recess to be the remainder of the week (Thursday, Friday and Saturday) after the close of the semi-annual examinations; the April recess to be four days including April 19th."

Until the present time it has been the custom to have informal intermediate reports sent to parents or guardians at the end of the first five weeks and the second five weeks in each term of the first two years. This arrangement still continues for the first term of the first year, but in the second term of the first year and in each term of the second year hereafter but one such report is to be sent, which will be at the end of seven weeks.

The Committee on Faculty Business has considered the advisability of establishing an Honor Society at the Institute, and on request of this committee the Faculty has appointed a special committee to consider such a plan. This committee has not yet, however, presented its report.

The question has also been raised as to the present method of classifying our students in the Catalogue, it being felt by many that the long list of so-called special students, which last year was four hundred and seventy-five, might give rise to misunderstanding as to the nature of the work pursued by so large a body of our students. The Committee has presented a report, and if the recommendation which they propose is approved, about one half of the students in this list of specials would be included in the lists under the respective years,—first, second,

third and fourth; a relatively small number (about eighty in last year's list) would still be called special students, but with the distinct statement that they were admitted to the Institute to take special courses of study. The remainder would be considered as unclassified students.

In June, 1910, the Faculty recommended two students for the degree of Doctor of Philosophy, one for the degree of Doctor of Engineering, nineteen for the degree of Master of Science and two hundred and fifty-two for the degree of Bachelor of Science.

There were admitted to the Institute in November, 1910, one hundred and ninety-eight new students who have attended other colleges for one year or more. Of these ninety-four have already received the Bachelor's degree from the college previously attended.

A. L. MERRILL,
Secretary of the Faculty.

REPORT OF THE DEAN.

The general condition of undergraduate life at the Institute is much the same as last year. The control of student organizations by the Institute Committee is becoming more practically efficient and the various committees connected with the management of the Union feel a more definite responsibility for the success of the enterprise. The Dining-Room Committee of the Union has always had a most difficult task, but the result of last year's work was satisfactory financially and otherwise, due mainly to the efforts of the President's Assistant, Mr. Maurice R. Scharff. The attendance at the beginning of this school year of 1910–'11 is much larger than that of the previous year.

About the middle of last year a Cosmopolitan Club was organized, with the intention of including in its membership all students having their home residence in a foreign

country, and such American students as should be elected by a committee; the membership of American students being limited to one third the total number of foreign students. This Club is not dissimilar to many such clubs that have been formed in other colleges and universities in the Country. The opportunity for forming such a club at the Institute is most favorable. We have always had a large number of foreign students, and under the conditions of city boarding-house life such students rarely gain the full benefit of acquaintance with their classmates, thus being deprived of many of the advantages that come from student work in a foreign country. The initiative in the formation of this club came from one of the senior Civil Engineering students, Mr. Gorton James. It was taken up heartily by the President and Dean, and several members of the Faculty and Corporation united in supporting the project. Two rooms were secured nearly opposite the Rogers Building on Boylston Street, and one of these rooms was fitted up as a study, or reading-room, supplied with foreign periodicals and magazines, stationery, and a piano. Evening entertainments were held at these rooms, and afternoon teas, to which ladies were invited, were held at the time of the Junior Week festivities, and at the time of graduation. An entertainment under the charge of the Chinese students was noticeably successful. This year there are some ninety-four students whose homes are in foreign countries, and there are one hundred and ninety-three students at the Institute who were born in foreign countries. There are now twenty-seven Chinese students at the Institute,—a large number of these being sent by the Chinese government. There is every reason to believe that this Cosmopolitan Club will be helpful and educational to both its foreign and American membership.

During the past year the Dean kept his morning office hours, (ten to twelve) continuously throughout the summer vacation, and his experience leads him to believe that

it is absolutely necessary for the Institute to have some one of the officers of the Faculty in attendance throughout the entire year. There was no day when there were not some inquiries which had to be answered authoritatively by an officer of the Faculty. There were always visitors and prospective students inquiring about the Institute and the requirements for admission. The number of callers during the month of August averaged at least five a day. In the past it has been the custom to regard the month of August as the best one for the vacations of the Institute officers. Experience proves that it is not wise that all the officers of the Faculty should be absent during this month.

The Gymnasium during the past year was in charge of Mr. Frank M. Kanaly, assisted by Mr. Joseph McNamara. During the first month the men attended lectures on personal hygiene by Professor Sedgwick and Dr. White, and were required to take a physical examination, from which could be plotted an anthropometric chart. Regular gymnasium work began immediately after Field Day, November 8th, and continued until April 15, 1910. This gave the required twenty weeks of gymnasium work for the year. During the first term two hundred and ninety students attended the course; during the second term two hundred and eighty-three. Forty-five first-year students substituted track athletics for gymnasium work. Nineteen students were excused for physical disability; thirty-one on account of age. Fifteen students failed to receive a passing mark in the course, and were required to repeat the work this term. Failure, in general, was caused by continued absence. A physical examination was given in April, 1910. The measurements taken at this examination were compared with those taken in October, and on the basis of this comparison the Cabot Medals were awarded to the following named students:—William B. Denton, '11; Scott W. Orr, '13; Norman D. MacLeod, '13, Lester F. Hoyt, '13; Francis H. Achard, '13. Practically all students taking gymna

sium or track work showed physical improvement at the end of the year, but the above named students were most regular in attendance, and showed most improvement in physical health and strength. Gymnasium work is required only for first-year students, but others are invited to attend and it is encouraging to note that the first award was to a third-year student.

The following table shows statistics with reference to residence of students obtained at the beginning of this school year together with a comparison of those obtained five years ago:—

	1910.	1905.
Students living at Home	630	685
Students living at Chambers or Bachelor Apartments	48	138
Students living at Fraternity Houses	200	139
Students boarding in City Proper	566	453
Students boarding in Suburbs	61	146

The number of students living at home has decreased and the number of those boarding in the City Proper has increased. The number of those living in boarding houses has been materially increased by the fact that we have a greater number of students now coming to us from other colleges. Eighty-five of the men now living in boarding houses in the city are graduates of other colleges, and an even larger number are men who have taken one or more years in some other college. The need of making provision for our students who come to us from a distance is more important today than it was five years ago. In 1905 the Dean recommended that the Institute try to secure a few good houses to accommodate about twenty-five men at each house, and he feels that the need for such a movement is more urgent now than it was then.

The fraternity houses, when run properly, afford one of the best practical methods for housing students at the Institute. There are usually not more than twenty men gathered together in any one fraternity. The fraternity unites men from all four classes and from all the different

departments of work at the Institute, and the control of these houses is in the hands of a committee of upper classmen, the alumni members of the Society furnishing the financial backing. Last year there were three hundred and sixty-nine students who were members of the Greek Letter fraternities. This represents almost exactly twenty-five per cent. of all students at the Institute.

Seventy-five per cent. of Technology students are not members of any fraternity. This proportion between fraternity and non-fraternity men has remained about the same for many years. If our alumni are anxious to do something that will be of immediate benefit to the undergraduates, they could hardly do better than to coöperate in a scheme for leasing ten or twelve good dwelling houses, and renting rooms in these houses to Institute students only. Each house should be controlled by a joint committee of undergraduates and alumni.

Reports of the Committees on First-Year Students and Conduct of Examinations, of which the Dean is Chairman, have been sent to the Secretary of the Faculty.

STATISTICS OF ILLNESS FOR THE SCHOOL YEAR 1909–10.

Fourth-Year Class.

There were three hundred and twenty-four students in the fourth-year class. Of these twenty were reported ill during the year. Classified by illnesses there were the following cases: Chicken pox, 1; diphtheria, 2; grippe, 1; influenza, 1; jaundice, 1; laryngitis, 1; nervous break-down, 2; pneumonia, 1; pulmonary tuberculosis, 1; scarlet fever, 2; synovitis, 1; not specified, 6.

Third-Year Class.

In this class there were three hundred and forty-one students, of whom twenty-two were reported ill during the year. The following cases were reported: Acute influenza, 1; appendicitis, 1; boil on arm, 1; conjunctivitis, 1; German measles, 1; grippe, 1; mumps, 1; nervous breakdown, 2; scarlet fever, 3; sore throat, 1; not specified, 9.

Second-Year Class.

This class numbered three hundred and ninety-five students, of whom [illegible] were reported ill during the year. There were the following cases: Ab-

scess, 1; acute diarrhœa, 1; acute indigestion, 1; appendicitis, 1; blood poisoning, 1; blow on head, 1; cold, 1; fever, 1; gall stones, 1; grippe, 4; injury to leg, 1; intestinal poisoning, 1; jaundice, 2; mumps, 2; neuralgia, 1; pneumonia, 1; scarlet fever, 3; septic infection of heel, 1; sore throat, 2; tonsilitis, 1; trouble with eyes, 3; ulcerated tooth, 2; water on elbow, 1; water on knee, 1; not specified, 20.

First-Year Class.

The first-year class numbered three hundred and seventy-five students. Of this number eighty-six were reported ill during the year. Classified by illnesses there were the following cases: Abscess, 4; asthma, 1; blister on heel, 1; blood poisoning, 3; broken arm, 1; bronchitis, 2; chronic synovitis, 1; cold, 9; contusion of hand, 1; cut on hand, 1; diphtheria, 1; eczema of legs, 1; gastritis, 1; grippe, 4; growth on ear, 1; influenza, 1; injury to head, 1; injury to heel, 2; injury to knee, 3; jaundice, 2; malaria, 1; measles, 1; mumps, 1; operation on foot, 1; pneumonia, 1; ptomaine poisoning, 1; rheumatism, 2; septic hand, 1; sprained ankle, 8; sprained knee, 3; stomach trouble, 1; surgical operation, 1; tonsilitis, 4; trouble with ears, 1; trouble with eyes, 3; tuberculosis, 1; ulcer on heel, 1; ulcerated tooth, 2; water on knee, 1; not specified, 15.

SUMMARY.

	No. in Class.	No. Ill.	No. of Deaths.
Fellows and Graduates	43	0	0
Fourth Year	324	20	0
Third Year	341	22	0
Second Year	395	50	0
First Year	375	86	0
	1,478	178	0

ALFRED E. BURTON,
Dean.

REPORT OF THE MEDICAL ADVISER.

The medical work of the Institute has been carried on along the same lines as in previous years. Consultation hours have been held on two afternoons a week throughout the school year, and as usual the students have fully occupied the time, and extra time usually was needed to accommodate all those who came for advice. The average extra time needed was thirty-eight minutes more than the appointed hour. For a small part of the year—about ten per cent. of the office hours—no extra time was needed, but

on many occasions between one and two extra hours were required.

The following table gives the number of office visits made and the number of students seen. A few figures of previous years are given for comparison:

	1908.	1909.	1910.
Total number of office visits made	318	432	464
Total number of different students seen	184	318	302
Greatest number of students seen per day			17
Least number of students seen per day			2
Average number of students seen per day			7
Number of students making more than one visit			76

These figures show that the number of students coming to the medical office has notably increased in the last two years, in comparison with the number three years ago. This increase is largely due to the requirements for Physical Training for the last two years, and the fact that a doctor's certificate is needed to explain absence from Military Drill or Physical Training on account of illness or disability. This increased work has required very little extra time, and has proved valuable. The recent requirement of Physical Training, valuable and legitimate as it is, has increased the work of the medical office in another way, by bringing to me a group of twenty-five or thirty men a year, with minor sprains and bruises which have occurred at the gymnasium or track. These injuries while they require attention and sometimes are acutely painful, are trifling in comparison to the benefit of regular physical exercise which is a legitimate part of our training. The simple and comparatively harmless nature of these injuries must be largely due to the careful supervision of the instructors of Physical Training and the type of athletic work which has been made popular at the Institute. It has been very gratifying to watch the results of regular physical exercises in the last two years as shown in certain men, who from a rather delicate condition at entrance, have grown steadily in bodily vigor in spite of exacting mental work.

The great majority of men found it necessary to make only one visit to the Medical Office, usually for the treatment of some acute and promptly curable condition; only six men made more than five visits, and eight was the largest number made by any one man. This is a good evidence of the general health of the students.

A great variety of illnesses were treated; the most numerous being diseases of the digestive apparatus, of the nose, and throat, and minor surgical diseases. About a dozen men suffered from severe illness, such as appendicitis, goitre, asthma, diphtheria, hernia and diseases of the heart or kidney. Eight men were involved in the epidemic of scarlet fever which occurred in Boston last year; two men had to leave the Institution on account of pulmonary tuberculosis; a small number of students were referred to specialists for the treatment of the eye, ear, or skin; and a few were referred to the Boston City Hospital or the Massachusetts General Hospital for the treatment of severe acute illness.

Occasionally a man is found whose difficulties are primarily financial rather than physical, whose ill health has been induced by his efforts to pay his own way through the Institution, for example, by teaching several hours every evening and tutoring all day on Sunday in addition to keeping up his regular work. Such cases have been referred to the Dean with satisfactory results.

In addition to the work at the Institution office I have seen about fifty men at my private office, and a small number at their homes. In addition to sick students twenty healthy men were examined for United States Civil Service, or for athletic work.

The cases of contagious disease at the Institute are always very few in comparison with colleges and other institutions of similar size, doubtless owing to the scattered residence of our students. This year we had one case of chicken pox, two of measles, three of diphtheria

and four of mumps. This year an epidemic of scarlet fever occurred in Boston and vicinity in the Spring as the result of an infected milk supply and eight of our students were involved. Four of the cases occurred in houses in each of which from five to fifteen Institute men lived together, but as a result of prompt quarantine of sick students and fumigation of infected rooms, there was little or no infection from one case to another. For example, in each of two houses where from eleven to fifteen men lived, one student was taken ill, but no other student infected. All men who were directly exposed to sick students were not permitted to attend exercises for one week, to make sure they were not incubating the disease, and spread of infection among the students was thus prevented. At this time quite a number of healthy men were seen at the office who feared lest they were developing scarlet fever.

Two talks on personal hygiene were given by the Medical Adviser to the Freshman class. With increased experience it has proved possible to adapt these talks more definitely to the needs of the student body. The following subjects were taken up: bathing, exercise, food, sleep, care of the eyes, use of tobacco and alcohol, minor ailments, and the prevalence and danger of venereal disease.

FRANKLIN W. WHITE, M. D.,
Medical Adviser.

REPORT OF THE LIBRARIAN.

At the close of the fiscal year ending September 30, 1910, the Libraries of the Institute contained 89,710 volumes and 19,740 pamphlets and maps; the total net increase of the year being 3,155 volumes, 622 pamphlets, and 68 maps.

The general catalogue contains 109,290 cards, of which 6,303 were added during the year.

The distribution and cost of the net additions to the several Libraries of the Institute, with the present contents of the Libraries, is shown in the following table.

The total additions to the General Library consist of 277 volumes and 79 pamphlets, 13 volumes of which were paid for out of the appropriation for the Department of English. The shelves being already overcrowded, 330 volumes and 190 pamphlets, mostly old college catalogues and similar books for which there was no further use, were discarded, so that there is a net decrease in the General Library of 27 volumes and 111 pamphlets.

Of the 128 volumes added to the Architectural Library, 32 volumes costing $88.03 were purchased from the appropriation for the Department of History from the gift of the Saturday Club.

TABLE OF THE NET INCREASE WITH THE COST OF THE SAME DURING THE YEAR 1909–1910, AND THE TOTAL CONTENTS OF THE LIBRARIES OF THE INSTITUTE, SEPTEMBER 30, 1910.

	Net Increase.				Total Contents.	
	Volumes.	Pamphlets.	Maps.	Cost.	Volumes.	Pamphlets and Maps.
General Library:						
General	(–40)	(–111)	—	$382.40	7,414	5,098
English	13	—	—	28.33	3,511	40
Military Science	—	—	—	—	367	9
Walker Memorial	—	—	—	—	485*	—
Other Departments	—	—	—	20.50	49	1
Totals General Library	(–27)	(–111)	—	$431.23	11,826	5,148
Architecture	128	2	—	$268.62	4,469	270
Biology	118	107	—	235.88	3,812	1,001
Chemistry	429	230	—	919.88	12,208	2,657
Electrical Engineering	130	16	—	210.40	1,833	109
Engineering	789	135	2	1,232.63	15,718.	5,469
Geology	310	58	66	239.97	4,309	3,236
History & Economics	458	146	—	417.08	14,806	3,955
Margaret Cheney Room	22	—	—	22.60	815	15
Mathematics	138	12	—	217.23	2,175	298
Mining	253	27	—	381.46	5,288	814
Modern Languages	47	1	—	79.42	1,892	57
Naval Architecture	111	3	—	232.86	1,667	196
Physics	249	96	—	381.19	8,892	1,393
Totals	3,155	722	68	$5,270.45	89,710	19,470

*Kept in the reading room of the Technology Union.

The total gross accessions for the year amount to 4,534 items, a decrease over the previous year of 1,889. The source of these is shown by the following table:

TOTAL ACCESSIONS, 1909–1910.

By Purchase	1,228
By Binding	1,164
By Gift, volumes	1,169
By Gift, pamphlets and maps	963
Total	4,534

The cost of the additions to the Library, exclusive of salaries, as shown by the bills approved by the Librarian, amount to $7,609.54, which is offset by $23.88 received from the sale of duplicates, making a total net cost of $7,585.66. These items are classified as shown in following table:

BILLS APPROVED, 1909–1910.

Purchase of books	$3,311.72
Binding	1,958.73
Subscription to periodicals	1,902.70
Equipment	170.75
Supplies	265.64
	$7,609.54
Less receipts from sale of duplicates	23.88
Total	$7,585.66

Periodical publications which are issued as frequently as four times a year are considered as "periodicals," and are chargeable, when approved by the Library Committee, to a special appropriation for the purchase of periodicals. Other serial publications are charged to the separate appropriations for the Departmental Libraries.

The following table shows the number received of both classes of publications for each department, and the estimated cost of the same.

TABLE OF PERIODICALS AND OTHER SERIAL PUBLICATIONS RECEIVED DURING THE YEAR 1909–10, CLASSIFIED BY DEPARTMENT AND METHOD OF PAYMENT.

LIBRARIES.	Number Received.				Estimated Cost.		
	Gifts.	Charged to Department.	Periodical Account.	Totals.	Department Account	Periodical Account.	Totals.
General	52	14	34	100	$46.05	$124.06	$170.11
Architecture	9	3	29	41	16.60	139.21	155.81
Biology	22	11	38	71	51.92	284.10	336.02
Chemistry	39	46	40	125	132.78	262.50	395.28
Electrical Engineering	8	11	24	43	30.40	97.70	128.10
Engineering	96	54	75	225	136.47	267.77	404.24
Geology	27	7	18	52	31.52	123.17	154.69
History and Economics	73	42	44	159	89.94	129.15	219.09
Margaret Cheney Room	—	6	—	6	19.20	—	19.20
Mathematics	4	7	18	29	17.30	83.85	101.15
Mining	40	13	30	83	45.76	126.75	172.51
Modern Languages	2	2	18	22	3.50	79.65	83.15
Naval Architecture	9	13	6	28	43.61	14.76	58.37
Physics	28	13	33	74	75.41	160.44	235.85
Totals	409	242	407	1,058	$740.46	$1,893.11	$2,633.57

The cost of the serial publications which are received regularly constitutes a fixed charge, either against the periodical account or the departmental appropriations as explained above.

Another fixed charge, which has not been separately tabulated in previous reports, is the charge for binding. The periodicals may be divided into two classes, (1) those of ephemeral interest, like newspapers; and (2) those containing original results of scientific and technical investigations, forming the most valuable portion of the Library. Publications of the first class are kept frequently only so long as they are of current interest, and then are discarded; but the periodicals of permanent value are bound in volumes and preserved with care in the Library.

The cost of binding these valuable publications forms thus in reality a fixed charge against the departmental appropriations. The amount of this charge resulting annually from the periodicals and other serials now taken and

bound regularly each year is shown in the following table, in which the figures under the headings "Periodicals" and "Serials" give the number of titles, not volumes, for each department. Sets of publications that are issued at irregular intervals, or are bound less frequently than once a year, have been omitted from the table.

ESTIMATED COST OF BINDING PERIODICALS AND OTHER SERIALS, 1910.

DEPARTMENTS.	Periodicals.	Cost.	Other Serials	Cost.	Total.	Total Cost.
General	24	$55.92	1	$0.90	25	$56.82
Architecture	30	71.03	2	2.68	32	73.71
Biology	27	44.02	2	2.10	29	46.12
Chemistry	79	145.78	3	2.75	82	148.53
Electrical Engineering	26	53.08	1	.47	27	53.55
Civil and Sanitary Engineering	82	127.60	4	6.07	86	133.67
Mechanical Engineering	46	95.15	1	1.20	47	96.35
Economics	61	80.86	3	3.10	64	83.96
History	11	16.05	1	.90	12	16.95
Geology	14	19.88	1	.75	15	20.63
Mathematics	25	54.85	1	1.15	26	56.00
Mining	47	83.10	4	4.40	51	87.50
Modern Languages	4	4.00	—	—	4	4.00
Naval Architecture	12	21.30	1	1.50	13	22.80
Physics	40	59.90	4	4.67	44	64.57
Total	528	$932.52	29	$32.64	557	$965.16

The actual amounts spent for binding by the different departments is shown in the following table. This includes, of course, not only the binding of the periodicals during the year, but also binding of foreign books and government publications, which are usually received unbound, the binding of pamphlets, and the replacement of bindings which have been worn out by use, or have otherwise deteriorated.

EXPENDITURES FOR BINDING, 1909–10.

General	$166.08
Architecture	164.60
Biology	28.40
Chemistry	287.94
Civil and Sanitary Engineering	319.94

Mechanical Engineering	$127.50
Electrical Engineering	104.10
Geology	149.05
History	13.40
Economics	121.30
Mathematics	80.98
Mining	187.01
Modern Languages	13.10
Naval Architecture	45.10
Physics	145.23
Other Departments	5.00
Total	$1,958.73

During the year there have been issued for the purchase of books 1,133 orders, and for binding 1,663 orders, a decrease of 204 and 55, respectively, over the previous year.

The circulation of books for home reading as reported by assistants or other persons in charge of Departmental Libraries is as follows:

CIRCULATION.

General Library	1,326
Architecture, Books	1,950
Architecture, Photographs	3,275
Biology	350
Chemistry	2,243
Engineering	2,070
Geology	208
Mining	1,227
Naval Architecture	921
Physics	1,555

The only Library open in the evening is the General Library, which is closed at 10 p. m. The attendance during 144 days was, from 5–7 p. m., 1,982, from 7–10 p. m., 884, Total 2,866, making an average from 5–7 of 13.7, and from 7–10 of 6.1.

There have been no changes in the Library staff during the past year. The Librarian has attended meetings of

the Massachusetts Library Club and of the Association of the New England College Librarians; and in connection with the latter Association took part in the dedication of the new library at Smith College, and inspected the libraries of Amherst College, Amherst Agricultural College, and Mount Holyoke College. During the summer he visited also the libraries of the Natural History Museum in South Kensington, London; of the Marine Zoölogical Station in Trieste; and the Marine Zoölogical Station in Naples. Miss Bertha P. Trull, A.B., Chief Assistant, attended the International Congress of Archivists and Librarians held in Brussels, August 28–31.

The Librarian has also joined the Special Libraries Association, a society composed largely of the librarians connected with engineering and commercial establishments; and the Institute is coöperating with this association so far as can be done without impairing the usefulness of the Library for our own officers and students. The Library of the Institute also coöperates with other libraries in the system of inter-library loans. By this system books are not lent to outside individuals, but are lent to other libraries, who are responsible for their safe return.

During the year, we have received three large gifts of money: from the Saturday Club, from Dr. C. G. Weld, and from Mrs. W. B. Rogers. The gift of the Saturday Club has been used for the purchase of books for the Library of History and Economics and for the General Library. Altogether 144 volumes were purchased from this fund. Dr. Weld's gift is for the purchase of books for the Department of Naval Architecture, and from this we have received twenty-six volumes and subscribed to three periodicals. Mrs. Rogers's gift is applied to the purchase of periodicals.

In addition to these gifts the Institute has received from Professor Talbot, Cincinnati Water Works, Report to Board of Trustees; Schimpf, Volumetric Analysis; Cob-

lentz, Volumetric Analysis; and Brownlee *et al.*, First Principles of Chemistry; from Professor Spofford, Gilbreth's Bricklaying System, another copy of which was received as a gift from the author; from Professor Richards, the final two volumes of his monumental work on Ore Dressing, and his Mining Engineering Notes, Vols. 1 and 2, also, the Copper Handbook for 1906, and his Text-Book of Ore Dressing; from Professor Dewey, forty-one volumes and pamphlets on economic subjects; from Professor Mulliken, his work on the Identification of the Commercial Dyestuffs; from Professor Russell, his Text-Book on Hydraulics; from Messrs. Hall & Phelan, their Translation of Biltz Experimental Inorganic Chemistry; from Mrs. Richards, Laboratory Notes on Industrial Water-Analysis; from Professor F. J. Moore, his Outlines of Organic Chemistry.

Gifts of one or more volumes have been received also from Mr. G. W. Rolfe, from Professor Gill, Professor Porter, Professor Vogel, Dr. Loughlin, Professor Goodwin, Professor Cross, Professor Allen, Professor Johnston, Professor Tyler, Professor Robbins, Professor H. W. Smith, and Professor Peabody.

Mr. Herbert N. Casson has presented us with his life of Cyrus Hall McCormick; Mr. Frank H. Rogers, Shakespeare's Julius Cæsar, Verulam edition. From the Newton Free Library, we have received the Report of the United States Engineer on the Survey of Mississippi River with atlas; from Mr. Harry W. Clark, Chief Chemist, Massachusetts State Board of Health, a Review of Twenty-One Year's Experiments upon the Purification of Sewage, written by himself and S. DeM. Gage of the class of '96; from Mrs. W. B. Rogers, seven volumes of miscellaneous subjects for the Margaret Cheney Room; from Mr. S. R. Mackellar, special student, a copy of Parkman's Oregon Trail; from Mr. Thomas E. Murray, his book on Electric Power Plants; from the Director of the Geological Survey

of India, two volumes of the Memoirs of the Survey; from the Editors, Technique, 1911; from the Department of Physics of Columbia University, Bjerknes's Fields of Force and Lorentz's Theory of Electrons; from the Yale University Library, New Haven Mathematical Colloquium; from J. Scott MacNutt, '08, thirteen volumes on engineering subjects; from the Memorial Committee, Lord di Naosuke and New Japan; and from the library of William Jackson, late city engineer, seventy-three volumes on engineering subjects, given by his son, William S. Jackson.

ROBERT P. BIGELOW,
Librarian.

REPORT OF THE REGISTRAR.

Besides the usual statistics of registration two other subjects are presented in this report. One of these is a graphical representation of the Institute course schemes. As changes are being made continually the program of studies followed by one class throughout its four years is shown. The class chosen was that which was graduated at the end of the first year of the present administration and in the national census year. In this presentation the time devoted to the subjects of the thirteen prescribed undergraduate Courses is shown graphically.

In the diagrams the area of the larger circle represents the 4,760 hours of exercise and preparation of the four years. As the schedules of all the Courses are the same for the first term of the first year, and nearly alike in the second term, the time given to the first year is shown separately. The inner circle, one quarter the area of the outer circle, represents the 1,420 hours of the first year. The remaining three quarters of the larger circle represents the hours of the second, third, and fourth years.

Each of these areas is divided into parts that are proportional to the time given to the subjects taught by the several departments of the school. The shaded areas refer to History, Economics, and Modern Languages. The unlabeled sector of the smaller circle represents the time devoted to Physical Training.

It is evident from these drawings that a considerable part of the time of all the Courses is given to strictly non-technical subjects. All the Courses are broad based and in nearly every one the students receive instruction in several different departments of the Institute. In such Courses as Architecture, Chemistry, Biology and Physics, the amount of time devoted to purely professional subjects is naturally greater than in the others, but even here it is apparent that the Courses are somewhat general.

Another subject presented is the result of a statistical inquiry with regard to the standing at the Institute of students from certain preparatory schools in Boston and its neighborhood. These results may be of interest to the public and they are, therefore, presented herewith. They are based on the records of the students who have entered the Institute during the past twelve years. Almost a thousand records were reviewed during this research and an estimate was made of the standing in each of the two terms of the four years of the students who graduated from the Institute and it was also noted whether or not the other students left in good standing.

Similar estimates of records have been made for other purposes for more than ten years, and due account is taken of the different amount of time given to the subjects of each term and whether or not the exercise is lecture, recitation or laboratory. With this in mind the quality of the records for each term are expressed in one of five groups. For each school the total points made by the student compared with the greatest possible number that could be obtained is expressed in this report in per cent.

In the tabulated results the schools are separated into two main groups, the Boston public schools, and the suburban schools. The former is subdivided into four divisions—two of schools that have sent more than one hundred students, one of the district high schools that together have sent more than one hundred, and the fourth of the Girls' High and the Boys' Latin. In the table, printed below, the number that entered from these schools is given and the per cent. of these that graduated. Under the head of "Failures" is given the per cent. that left in poor standing before the completion of the Institute's course. The average standing of the students from these preparatory schools who graduated from the Institute is given in one column for the whole four years and in another column for their first year at the Institute. The average for the several groups of schools has been calculated and also for the entire list of schools.

It is to be expected that the effect of four years' training at the Institute will tend to remove the inequalities due to differences of preparation, and it is not surprising to find a small average deviation in the standing for the four years at the Institute. The average deviation for the first year is larger and that for the per cent. of failures is considerably larger.

In connection with the report of the registration of the school it seems appropriate to mention the fact that the Institute sent a delegate to a convention of Secretaries and Registrars of Land Grant Colleges held last summer in Detroit. An important topic under discussion was the need, and suggestions for a method, of transferring records from one college to another by a uniform scheme. It was the unanimous opinion of those present (some twenty-five colleges being represented) that in transferring a student's record his complete standing should be given; this would include the subjects in which he has failed as well as the subjects in which he has passed. It was also the sense of

the meeting that such a form of report should be used as would give, besides the list of the subjects and an explanation of the records used, information showing how much time is devoted to each of the subjects and how the subject is given, that is, by lecture, recitation or laboratory. A similar convention will be held next summer in Boston, at the Institute.

Should the number of students who attended Summer School and who did not return to the Institute for the regular school year, and those who were not here in the first term, but attended in the second term last year be included, the total registration for the year would be over 1,580. The registration is, however, 1,506, which is 27 or 2 per cent. larger than last year, the statistics here given being based on the registration of November 1, 1910.

The increase is due partly to the return of a larger number of our own students, partly to an increased number of men from other colleges and partly to the exceptionally large number of foreign students. The per cent. of special students is thirty-nine. The Faculty has been increased by six since last year, and the Instructors and Assistants by five. Not including lecturers, who are appointed annually, the ratio of the members of the Instructing Staff to the number of students is 1 to 6.6. Ten years ago it was 1 to 9.2, and in 1902 it was 1 to 9.8.

In numbers the Courses in Civil, Mechanical and Electrical Engineering have led for several years, with the Course in Mining as the next largest, but this year, Chemical Engineering has become the fourth in size, having made a large gain that has placed it ahead of Mining Engineering.

The distribution of students among the Courses has increased in Civil Engineering, Architecture, Electrical Engineering, Physics, Chemical Engineering and Electro-Chemistry. There has been no change in the registration

in the Courses of Mining and Chemistry. The greatest gain in any one course is indicated by the registration in the Course of Chemical Engineering, where it has increased more than 50 per cent. over last year. Not only has the increase been great in the second year in the course, but through the other two years. It should be noted that the course registration is not counted in the first year, as students do not elect their course until the end of the first term.

Of the students admitted on the basis of examination 61 per cent. this year were admitted clear, last year 46 per cent.; 1 per cent. more than last year were rejected at the entrance examinations.

The age of the regular students of the first year (deducting one who is repeating the year and twelve of unusual age) is nineteen years, which is the same as it was last year. It has varied from year to year and ten years ago it was eighteen years and eleven months. Only once has it been over nineteen years.

Of the new students 34 per cent. are from other colleges and 27 per cent. of the whole registration is made up of such students.

It is shown, by grouping the students who have entered from other colleges, by the years that they spent in the previous college, that the largest group spent four years at college; they formed 51 per cent. of those who have come this year, and almost 50 per cent. last year. The figures for several years past show that these students either spend one or two years or wait until they graduate from their college before entering the Institute.

Once more, as has been the case generally, the largest number of men from other colleges has joined the third-year class. Last year, however, the number entering the second and third years was nearly the same.

The number of college graduates has risen again and has now reached 207 and the colleges or universities whence

these graduate students come has risen to 103. It was eighty-four last year. The graduates taking work for advanced degrees has risen to thirty-six.

A new table prepared this year is one to show the distribution of students from other colleges among the professional courses of the school. The largest per cent. of such students, excepting the Course in Naval Construction, to which only college graduates are admitted, is 43 per cent. in Chemistry and more than half of these students are college graduates. In the Engineering Courses, Civil Engineering leads with 35 per cent. of whom almost half are graduates.

The homes of the United States' students are in forty states, one territory, the District of Columbia, Porto Rico, the Phillipine Islands and the Canal Zone. As the number of United States students is not much larger than last year so the number from the various districts of the country, such as the North Atlantic, South Atlantic, South Central States, etc., has not changed materially; yet the number from the North Central States is greater and Illinois in that district leads in the gain.

The number of students from Massachusetts continues to be more than half of the total school. This year it is 50.6 per cent. and as formerly, the counties that are represented by the largest number of students, in their respective order are: Suffolk, Middlesex, and Essex. Four more towns are sending students to the Institute this year than last year.

The foreign students have increased in number from 79 to 102. This is the largest gain in the history of the Institute. Instead of the thirty countries that were represented last year, the students come from thirty-six different countries this year. The largest delegation from any one country are the twenty-seven from China.

Relatively fewer students from other colleges attended the Summer School during the past summer; the total

registration was, however, larger than last year, but not as large as the year before. Over 40 per cent. of the registrations were to anticipate work.

The amount of undergraduate scholarship assistance given during the school year of 1909–10 was $21,515. The total number of students assisted from these funds was 199. In addition to this, eighty students were aided by the State, there being a total of 253 students receiving scholarship assistance, or 17.1 per cent. of the whole number of students at the Institute.

The usual tables follow with graphical representation of the Course Schemes and the statistics concerning certain preparatory schools.

STANDING OF STUDENTS FROM CERTAIN PREPARATORY SCHOOLS.

	Number Entering.	Per cent. Graduating.	Per cent. of Failures. (This includes all who left in poor standing)	Standing of Students who graduated indicated by the deviation from the average on an arbitrary scale; + means above the average and − below the average.	
				During first year	During whole course
Boston Public Schools . .	577	53	36	+6	+2
A					
English High	200	61	28	+16	+ 2
Mechanic Arts High . .	234	45	44	−22	− 3
B					
Brighton High 9					
Charlestown High 8					
Dorchester High 27					
East Boston High 15	108	50	38	+16	+ 3
Roxbury High 40					
South Boston High 4					
West Roxbury High 5					
C					
Girls' High	13	69	31	+149	+58
Latin (Boys)	22	73	23	+11	+ 2
C	35	71	26	+61	+12
B & C	143	55	35	+30	+ 9
Suburban Schools	407	61	31	− 8	− 3
Brookline High	38	47	45	−28	+ 3
Cambridge	95	58	36	− 4	− 1
English High	47	66	30	+44	+ 6
Latin High	11	36	55	+ 5	+ 6
Rindge Man. Train. .	37	54	38	−80	−13
Everett High	13	62	23	+72	− 1
Hyde Park High	26	69	19	+ 5	−15
Malden High	58	64	28	+32	+10
Newton High	133	61	29	−26	−10
Somerville High	52	67	29	−32	± 0
Total Boston and Suburban	992	56	34	± 0	± 0

THE CORPS OF INSTRUCTORS.

	1906-07.	1907-08.	1908-09.	1909-10.	1910-11.
Professors	39	43	44	44	45
Associate Professors	18	18	18	14	20
Assistant Professors	21	25	33	32	31
Faculty	78	86	95	90	96
Instructors	69	72	62	69	66
Assistants	52	52	50	51	55
	121	124	112	120	121
Faculty, Instructors and Assistants	199	210	207	210	217
Research Associates	8	8	6	12	8
Research Assistants	3	3	1	1	5
	11	11	7	13	13
Lecturers	31	32	31	18	21
Total	241	253	245	241	251

YEARLY REGISTRATION SINCE THE FOUNDATION OF THE INSTITUTE.

Year.	No. of Students.	Year.	No. of Students.	Year.	No. of Students.
1865–66	72	1881–82	302	1897–98	1,198
1866–67	137	1882–83	368	1898–99	1,171
1867–68	167	1883–84	443	1899–00	1,178
1868–69	172	1884–85	579	1900–01	1,277
1869–70	206	1885–86	609	1901–02	1,415
1870–71	224	1886–87	637	1902–03	1,608
1871–72	261	1887–88	720	1903–04	1,528
1872–73	348	1889–98	827	1904–05	1,561
1873–74	276	1889–90	909	1905–06	1,466
1874–75	248	1890–91	937	1906–07	1,397
1875–76	255	1891–92	1,011	1907–08	1,415
1876–77	215	1892–93	1,060	1908–09	1,461
1877–78	194	1893–94	1,157	1909–10	1,479
1878–79	188	1894–95	1,183	1910–11	1,506
1879–80	203	1895–96	1,187		
1880–81	253	1896–97	1,198		

THE STUDENTS.

REGISTRATION BY CLASSES.	Regular.		Special.		Total.	
	1909.	1910.	1909.	1910.	1909.	1910.
Resident Fellows	4	1	—	—	4	1
Other Candidates for advance degrees	29	35	—	—	29	35
Fourth Year	224	191	116	113	340	304
Third Year	191	195	144	202	335	397
Second Year	228	219	167	185	395	404
First Year	318	283	58	82	376	365
Total	994	924	485	582	1,479	1,506
Non-resident Fellows	—	—	—	—	2	3

REGULAR AND SPECIAL STUDENTS BY COURSES FOR THE CURRENT YEAR.

YEAR.	Civil Engineering.	Mechanical Engineering	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Science.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Naval Construction.	Electro-chemistry.	Total.
Graduate	2	2	—	6	1	4	4	—	—	—	—	—	—	3	—	22
4th { Reg. . .	36	40	11	5	8	42	1	1	1	18	16	—	4	4	5	191*
4th { Sp. . . .	21	14	12	24	8	18	3	1	—	7	—	—	5	—	—	113
3d { Reg. . .	37	36	10	6	5	52	3	4	—	28	11	—	2	2	—	195
3d { Sp. . . .	45	30	23	23	9	32	5	1	—	14	11	—	6	—	5	202*
2d { Reg. . .	46	43	16	13	8	33	2	—	1	39	5	—	4	—	13	219*
2d { Sp. . . .	33	33	18	36	5	29	1	—	—	22	3	—	5	—	3	185*
Total { Reg. . .	121	121	37	30	22	131	10	5	2	85	32	—	10	9	18	605*
Total { Sp. . . .	99	77	53	83	22	79	9	2	—	43	14	—	16	—	8	500*
Total . . .	220	198	90	113	44	210	19	7	2	128	46	—	26	9	26	1,127*

THE SAME CLASSIFICATION FOR FIVE YEARS.

YEAR.	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Science.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Naval Construction.	Electro-chemistry.
1906-07	210	214	100	102	51	193	10	18	0	55	32	2	43	18	—
1907-08	210	227	118	84	53	202	17	21	2	59	39	0	37	16	—
1908-09	197	197	104	91	60	209	20	19	4	71	52	2	41	13	—
1909-10	207	204	99	109	44	203	22	4	4	84	60	1	41	14	14
1910-11	220	198	90	113	44	210	19	7	2	128	46	—	26	9	26

NUMBER OF STUDENTS PURSUING CERTAIN LEADING BRANCHES OF STUDY.

	First Year.	Second Year.	Third Year.	Fourth Year.	Total.
Chemistry	352	144	137	80	713
English	338	329	47	—	714
French	28	19	26	—	73
Geology	—	31	138	19	188
German	323	129	22	—	474
Mathematics	406	378	169	16	969
Mechanic Arts	—	149	55	81	285
Physics	—	391	346	65	802

*Deducting names counted twice.

STATISTICS OF ADMISSION.

	Regular.	*Special.*	*Total.*
Admitted clear	144	0	144
" with one condition	67	7	74
" with two conditions	20	13	33
" with three conditions	3	10	13
" with four conditions	0	5	5
" with five conditions	0	2	2
" on examination	234	37	271
Total First-year Class	283	82	365

Admitted but did not enter		31
Candidates at June Entrance Examinations		575
Candidates rejected in June	Complete candidates	5
	Final "	4
	Preliminary "	66
	Partial "	27
		102
Candidates in September for Entrance and Advanced Standing Examinations		255
Candidates rejected in September	Complete candidates	7
	Final "	4
	Preliminary "	12
Certificates of the College Entrance Examination Board submitted		109

TOTAL REGISTRATION AND NUMBER OF NEW STUDENTS FOR TEN YEARS.

YEAR.	(1) Total No. of Students.	(2) No. of Students in the Catalogue of the previous year who remain in the Institute.	(3) No. of New Students entering before issue of Catalogue.	(4) Of those in column (3) the following number are regular First-year Students.	(5) No. of New Students not of the regular First-year Class.
1901–1902	1,415	844	571	396	175
1902–1903	1,608	949	659	433	226
1903–1904	1,528	1,042	486	249	237
1904–1905	1,561	986	575	295	280
1905–1906	1,466	984	482	213	269
1906–1907	1,397	862	535	272	263
1907–1908	1,415	888	527	273	254
1908–1909	1,462	868	594	323	271
1909–1910	1,479	890	579	317	262
1910–1911	1,506	944	562	283	279

Regular Five-year Students.

Year.	Total.	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Science.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Electro-chemistry.
1st	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2d	11*	2	2	—	—	1	3	—	—	1	1	1	—	—	—
3d	6*	—	1	—	—	—	3	—	—	—	2	—	—	—	—
4th	4*	1	1	—	—	—	1	—	—	—	—	1	—	—	—
5th	15*	—	4	2	—	1	4	—	—	—	—	2	—	—	2
	37*	3	8	2	—	2	11	—	—	1	3	4	—	—	2

Women Students.

Course.	Architecture.		Chemistry.		Biology.		Chem. Eng.		Total.
Year of Course.	Regular.	Special.	Regular.	Special.	Regular.	Special.			
Graduate	—	—	—	—	—	—	—	—	—
Fourth	—	1	—	—	—	—	—	—	1
Third	—	1	—	2	—	1	—	—	4
Second	—	1	—	1	—	—	—	1	3
Special, without course classifications									2
Totals	—	3	—	3	—	1	—	1	10

New Students from Other Colleges by Years.

Class, Joined at Institute.	Years Spent at College.				Total.
	One.	Two.	Three.	Four, or more.	
First Year	16	10	1	15	42
Second Year	16	18	5	21	60
Third Year	—	10	16	39	65
Fourth Year	—	—	2	10	12
Graduate Year	—	—	—	13	13
Total	32	38	24	98	192

GRADUATE STUDENTS.

American Colleges and Universities Represented.

Amherst	2	Mississippi Agricultural	1
Armour Institute	1	Missouri	2
Austin	1	Montana	1
Bates	3	Nebraska	1
Beloit	1	Oberlin	2
Boston College	1	Oregon	1
Boston University	2	Oregon Agricultural	1
Bowdoin	4	Otterbein	1
Bradley Polytechnic Institute	1	Pennsylvania Military	2
Brown	4	Pennsylvania State	1
Bryn Mawr	1	Pomona	1
California	2	Princeton	3
Canisius	1	Radcliffe	1
Central	1	Rhode Island Agricultural	1
City of New York	4	Rochester	3
Colorado	1	Saint Louis	6
Cornell	2	Saint Xavier	3
Dakota Wesleyan	1	Sacred Heart	1
Dartmouth	6	Smith	1
DePauw	1	South Carolina	1
Franklin and Marshall	1	South Dakota	1
Georgia	1	Spring Hill	2
Gonzaga	1	Texas	2
Grinnell	1	Texas Agricultural	2
Hamilton	2	United States Naval Academy	9
Harvard	11	Van Buren	1
Holy Cross	1	Vermont	1
Indiana	1	Virginia	2
Iowa State	1	Virginia Military	2
Johns Hopkins	3	Virginia Polytechnic	1
Kansas	3	Washington	1
Kansas Agricultural	2	Washington and Jefferson	3
Lafayette	1	Washington and Lee	3
Lehigh	1	Wesleyan	2
Leland Stanford Junior	2	Western Reserve	1
Macalester	1	Whitman	1
Maine	1	Whitworth	1
Marietta	2	Williams	3
Maryland Agricultural	1	William and Mary	1
Massachusetts Institute of Technology	11	Wisconsin	1
Michigan	1	Wooster	1
Middlebury	2	Yale	13
Minnesota	1		
Mississippi	1		181

Foreign Colleges and Universities Represented.

Academia de Ingenieros del Ejercito (Guadalajara)	1	Paris (France)	1
Anhui Provincial (China)	2	Shantien (China)	1
Bergakademie (Freiberg)	1	Syrian Protestant (Beirut)	2
Cambridge (England)	1		29
Chili Provincial (China)	1		
Ecole Polytechnic (Montreal)	1	Total from American Colleges and Universities	181
Escuela Industrial (Buenos Ayres)	2	Total from Foreign Colleges and Universities	29
Greece National (Athens)	1		210
Imperial Polytechnic (Shanghai)	8	Counted twice	3
Japanese Naval Engineering (Tokio)	1		207
McGill (Montreal)	2		
Melbourne (Australia)	1		
National (Buenos Ayres)	2		
New Brunswick (Fredericton)	1		

Graduates who are candidates for Advanced Degrees 32
Graduates who are pursuing undergraduate work 175
Colleges and Universities represented 103

College Students Among the Courses.

Graduates and Students from Colleges.	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Science.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Naval Construction.	Electro-chemistry.	Total.
Graduates	31	30	5	25	10	35	8	3	—	15	4	—	2	9	2	179
Non-graduates	47	21	13	22	9	31	—	—	—	16	2	—	7	—	—	168
Total	78	51	18	47	19	66	8	3	—	31	6	—	9	9	2	347
Proportion, in per cent., of these students in the courses.																
Graduates:	14	15	6	22	23	17	42	43	—	12	9	—	8	—	8	16
Non-graduates:	35	26	20	42	43	31	42	43	—	24	13	—	35	100	8	32

Ages of Students.

The Graduating Class, June, 1910.

Under 20½	5
Between 20½ and 21	4
" 21 " 21½	15
" 21½ " 22	25
" 22 " 23	74
" 23 " 24	59
" 24 " 25	30
" 25 " 26	16
26 and over	24
Total	252

The average age was 22 years and 7 months.

Regular First-Year Students.

Period of Life.	1909–1910.		1910–1911.	
	Half-year Groups.	Yearly Groups.	Half-year Groups.	Yearly Groups.
16 to 16½ years	—	—	—	—
16½ to 17 "	4	4	2	2
17 to 17½ "	17	—	12	—
17½ to 18 "	20	37	30	42
18 to 18½ "	53	—	60	—
18½ to 19 "	70	123	43	103
19 to 19½ "	49	—	47	—
19½ to 20 "	31	80	24	71
20 to 20½ "	16	—	20	—
20½ to 21 "	16	32	15	35
21 to 22 "	16	16	17	17
	292	292	270	270

Repeating the first year 1
Students of unusual age 12
Average age, omitting these 13 . . . . . 19 years.

Graduates by Years and Courses.

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Natural History or Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Electro-Chemistry.	Total.	Degrees Granted by Decades.
1868	6	1	6	—	—	—	—	—	1	—	—	—	—	—	14	
1869	2	2	—	—	1	—	—	—	—	—	—	—	—	—	5	
1870	4	2	2	—	1	—	—	—	1	—	—	—	—	—	10	29
1871	8	2	5	—	2	—	—	—	—	—	—	—	—	—	17	
1872	3	1	5	—	3	—	—	—	—	—	—	—	—	—	12	
1873	12	2	3	1	7	—	—	—	1	—	—	—	—	—	26	
1874	10	4	1	1	—	—	—	—	2	—	—	—	—	—	18	
1875	10	7	6	1	1	—	—	1	2	—	—	—	—	—	28	
1876	12	8	8	—	5	—	2	3	4	—	—	—	—	—	42	
1877	12	6	8	4	2	—	—	—	—	—	—	—	—	—	32	
1878	8	2	2	3	3	—	—	—	1	—	—	—	—	—	19	
1879	6	8	3	1	3	—	1	1	—	—	—	—	—	—	23	
1880	3	—	3	—	1	—	—	—	1	—	—	—	—	—	8	225
1881	3	5	6	3	8	—	1	—	2	—	—	—	—	—	28	
1882	2	5	5	3	6	—	1	1	1	—	—	—	—	—	24	
1883	3	7	5	1	3	—	—	—	—	—	—	—	—	—	19	
1884	5	6	13	—	12	—	—	—	—	—	—	—	—	—	36	
1885	4	7	8	2	4	2	—	—	1	—	—	—	—	—	28	
1886	9	23	7	1	7	10	1	—	1	—	—	—	—	—	59	
1887	10	17	8	1	9	8	1	1	3	—	—	—	—	—	58	
1888	11	25	4	5	10	17	3	1	1	—	—	—	—	—	77	
1889	14	24	5	3	8	17	1	1	2	—	—	—	—	—	75	
1890	25	28	3	5	13	18	3	2	6	—	—	—	—	—	103	507
1891	18	26	4	6	11	23	3	3	1	7	—	1	—	—	103	
1892	22	26	4	13	7	36	6	1	7	4	6	1	—	—	133	
1893	25	30	5	2	8	41	2	—	6	8	—	2	—	—	129	
1894	21	31	4	14	11	33	1	3	5	12	3	—	—	—	138	
1895	25	30	3	15	14	33	—	2	4	11	4	—	5	—	144*	
1896	26	34	10	24	17	48	3	3	7	7	4	3	5	—	190*	
1897	25	40	7	16	20	33	2	3	7	12	4	1	9	—	179	
1898	32	41	7	29	25	33	3	4	6	9	3	—	7	—	199	
1899	30	37	9	22	22	32	2	2	1	10	1	—	8	—	173*	
1900	32	34	21	21	19	23	3	3	5	11	4	—	9	—	185	1,573
1901	37	39	18	21	17	25	1	1	6	14	4	1	16	—	200	
1902	24	46	14	18	14	35	5	3	3	9	7	—	14	—	192	
1903	26	37	27	15	13	39	1	4	1	10	4	1	12	—	190	
1904	34	45	32	24	15	34	3	13	5	7	2	1	17	—	232	
1905	46	54	26	12	23	31	3	3	3	13	5	1	24	—	244	
1906	47	69	38	22	21	37	2	7	—	10	6	—	19	—	278	
1907	37	52	22	21	10	32	—	5	—	14	3	2	10	—	208	
1908	48	61	19	19	16	38	4	2	—	15	2	—	5	—	229	
1909	51	41	30	18	12	42	5	3	—	13	9	—	5	3	232	
1910	57	57	24	18	10	36	3	—	2	18	12	—	11	3	251	2,256
Totals	845	1022	440	385	414	756	66	76	99	214	83	14	176	6	4,590*	4,590*

Names counted twice, students graduating in two different years	20
Bachelors of Science	4,570*
Masters of Science, not included in the above	53
Doctors of Philosophy and of Engineering, not included in the above	3
Total	4,626*

* Deducting names counted twice (students graduating in two courses).

STATISTICS OF GRADUATION, CLASS OF 1909.

Number receiving degree at end of one year	5
" " " " " two years	41
" " " " " three "	27
" " " " " four "	146
" " " " " five "	30
" " " " " six "	3
Total number of degrees of S. B. awarded	252
Number entering from other colleges	90
" graduates	47
" non-graduates	43

*Including names counted twice.

FURTHER STATISTICS OF THE STUDENTS FROM OTHER COLLEGES OF THE GRADUATING CLASS, JUNE, 1909.

Yrs. at the Inst.	*Graduate*	*Non-graduate.*	*Total.*
1	5	0	5
2	33	8	41
3	9	18	27
4	0	15	15
5	0	2	2
	47	43	90

SUMMER SCHOOL.

	1909.	1910.
Number from other colleges and schools attending	44	45
Number not referring to any other college or school	5	1
Number from Massachusetts Institute of Technology	166	193
	215	239
Number who registered, but did not attend	9	6
Number who applied but cancelled registration	1	5
Registrations for failures or deficiencies	140	194
Registrations to anticipate work	266	255
Number who attended Summer School but did not return for Registration	47	

NUMBER OF STUDENTS REGISTERED IN EACH OF THE COURSES OF THE SUMMER SCHOOL FOR THIS YEAR AND THE YEAR BEFORE.

	1909.	1910.		1909.	1910.
Applied Mechanics	19	23	Mechanical Drawing	20	11
Carpentry	7	3	Mechanical Engineering Drawing	15	24
Chemistry, Inorganic and Analytical	37	40	Mechanism	9	15
Chipping and Filing	3	4	Metal Turning	0	3
Descriptive Geometry	34	35	Organic Chemical Laboratory	7	9
Design	7	13	Pattern Work 122–123	8	3
English	6	4	Physical Laboratory	5	18
Field Geology	1	2	Physics	17	26
Forging	7	3	Precision of Measurements	4	7
French	6	3	Shades and Shadows	4	2
German	6	17	Structures	5	7
Machine Tool Work	29	21	Surveying	3	8
Mathematics (1)	17	32	Surveying (Field)	15	0
Mathematics (2)	12	15	Wood Turning	7	3

RESIDENCE OF STUDENTS.

NUMBER OF STUDENTS IN EACH YEAR, FROM 1902, COMING FROM EACH STATE OR TERRITORY.

STATES AND TERRITORIES.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
North Atlantic.									
Connecticut	43	44	48	50	36	29	31	32	33
Maine	35	34	26	22	18	23	22	20	24
Massachusetts	935	869	889	807	764	781	839	852	840
New Hampshire	34	23	36	32	26	27	24	27	27
New Jersey	8	13	16	11	15	17	14	14	18
New York	96	104	94	71	84	82	99	99	106
Pennsylvania	44	52	56	58	55	57	53	46	37
Rhode Island	40	28	19	24	23	28	28	30	27
Vermont	12	11	5	5	4	5	6	6	6
Total	1,247	1,178	1,189	1,080	1,025	1,049	1,116	1,126	1,118
South Atlantic.									
Delaware	4	3	2	1	2	1	–	1	–
Dist. of Columbia	17	15	17	13	12	10	10	8	5
Florida	2	2	4	3	3	3	6	5	1
Georgia	6	4	6	8	4	2	3	4	5
Maryland	27	25	18	19	17	18	17	12	14
North Carolina	6	7	1	–	1	–	1	–	–
South Carolina	4	–	–	1	3	2	–	2	1
Virginia	7	7	4	7	8	9	11	10	12
West Virginia	–	–	–	1	2	3	3	2	3
Total	73	63	52	53	52	48	51	44	41
South Central.									
Alabama	1	1	1	1	2	4	3	5	4
Arkansas	1	1	–	1	–	2	1	2	2
Kentucky	11	9	8	5	5	5	4	4	2
Louisiana	2	2	5	1	2	–	3	2	5
Mississippi	–	4	4	4	5	3	3	3	6
Tennessee	3	5	2	2	3	6	8	8	5
Texas	9	11	13	16	15	16	16	13	13
Total	27	33	33	30	32	36	38	37	37
North Central.									
Illinois	49	44	43	42	37	31	23	24	33
Indiana	14	6	10	10	15	12	9	11	10
Iowa	8	6	9	13	14	16	14	5	4
Kansas	1	1	4	7	6	5	4	6	9
Michigan	10	9	9	10	7	8	7	10	9
Minnesota	10	9	11	13	14	8	8	10	8
Missouri	20	22	25	29	17	14	6	7	13
Nebraska	5	4	5	4	2	3	2	4	6
North Dakota	1	1	1	–	3	4	3	3	3
Ohio	43	37	35	34	30	26	30	27	33
South Dakota	1	3	2	–	1	3	3	5	3
Wisconsin	11	13	14	12	7	12	12	11	9
Total	173	155	168	174	153	142	121	123	140
Western.									
Arizona	–	–	–	–	–	–	–	–	1
California	15	19	18	23	21	14	20	25	21
Colorado	10	11	16	17	12	10	5	6	9
Idaho	–	–	–	–	–	–	1	–	–
Montana	3	2	5	3	3	3	2	3	2
Nevada	–	–	–	1	1	1	1	–	–
New Mexico	1	1	2	–	–	1	1	1	–
Oklahoma	–	–	–	–	–	1	1	–	–
Oregon	4	7	8	5	2	3	4	7	8
Utah	2	3	3	2	3	3	5	5	3
Washington	3	3	2	2	5	12	13	11	9
Wyoming	1	–	–	2	5	1	1	1	–
Total	39	46	54	55	52	49	54	59	53

District.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
Canal Zone	–	–	–	–	–	–	1	1	1
Hawaii	–	1	1	1	2	2	1	2	2
Philippine Islands	–	–	4	2	3	1	1	1	4
Porto Rico	2	2	4	5	2	3	6	7	8
Total	2	3	9	8	7	6	9	11	15
Total for the United States	1,561	1,478	1,505	1,400	1,321	1,330	1,389	1,400	1,404

Number of Students in Each Year, from 1902, Coming from Each Foreign Country.

Foreign Countries.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
Argentine Republic	–	–	–	–	1	2	2	4	5
Armenia	–	1	1	3	2	2	2	–	–
Australia	2	3	1	3	3	3	–	–	2
Austria	–	–	–	–	–	–	–	–	–
Belgium	–	–	–	–	1	1	–	–	–
Bermuda	1	1	–	1	1	–	–	–	–
Brazil	5	3	3	1	–	2	3	1	2
Bulgaria	–	–	–	–	–	–	–	1	–
Canada	13	14	13	12	15	9	15	20	18
Cape Colony	–	–	–	–	1	1	1	–	–
Central America	–	–	1	–	–	–	1	–	–
Chile	1	1	1	2	1	1	1	1	3
China	1	2	8	8	7	9	10	11	27
Costa Rica	–	–	–	–	–	2	3	2	1
Cuba	2	3	4	4	4	4	2	7	5
Denmark	1	1	1	1	1	1	–	–	1
Ecuador	–	–	1	–	2	2	2	1	1
Egypt	–	–	–	1	2	2	2	1	1
England	3	4	4	5	6	4	3	–	1
Finland	–	–	–	–	–	–	–	–	1
France	–	–	1	1	–	–	–	–	2
Germany	1	2	–	–	–	–	–	1	1
Honduras	–	–	–	–	1	–	1	3	3
India	–	1	1	2	1	1	2	1	–
Ireland	1	1	–	2	2	3	1	–	–
Italy	–	–	–	2	–	2	1	1	1
Jamaica	–	–	1	–	1	–	1	1	1
Japan	1	2	1	3	5	3	4	4	4
Korea	–	–	2	–	–	–	–	–	–
Malta, Island of	–	1	1	–	–	–	–	–	–
Mexico	10	8	4	7	12	12	6	10	9
New Zealand	–	–	–	–	–	–	–	1	1
Norway	–	–	–	–	–	–	–	–	1
Panama	–	–	–	–	–	1	–	–	–
Paraguay	–	–	–	–	–	1	1	1	1
Peru	–	–	–	1	1	2	2	1	2
Poland	–	–	–	–	–	1	–	–	–
Russia	–	–	–	–	–	2	2	2	2
Scotland	1	1	2	1	1	1	–	–	0
Sweden	–	–	1	–	–	–	–	–	–
Switzerland	–	–	–	–	–	–	–	1	1
Syria	–	1	1	–	–	–	–	–	1
Transvaal	–	–	1	3	3	3	2	1	2
Turkey	4	–	2	1	1	2	1	2	2
Uruguay	–	–	–	2	1	1	1	–	–
Total	47	50	56	66	76	80	72	79	102
Total in school	1,608	1,528	1,561	1,466	1,397	1,410	1,461	1,471	1,506

Residence of Students for This School Year.

States.	Candidates for Advanced Degrees.	Fourth Year.	Third Year.	Second Year.	First Year.	All Regular Students.	Special Students.	Total.
Alabama	—	1	1	1	1	4	—	4
Arizona	—	—	—	—	1	1	—	1
Arkansas	—	—	1	1	—	2	—	2
California	3	2	2	1	2	10	11	21
Canal Zone	—	1	—	—	—	1	—	1
Colorado	—	2	—	—	—	2	7	9
Connecticut	1	1	4	5	9	20	13	33
Dis. of Co'bia	—	2	1	1	1	5	—	5
Florida	—	—	1	—	—	1	—	1
Georgia	—	3	1	—	1	5	—	5
Hawaii	—	—	—	1	—	1	1	2
Illinois	1	4	7	—	6	18	15	33
Indiana	2	1	2	—	—	5	5	10
Iowa	1	—	2	—	—	3	1	4
Kansas	3	2	—	1	1	7	2	9
Kentucky	—	—	1	—	—	1	1	2
Louisiana	—	1	—	1	1	3	2	5
Maine	—	4	4	—	3	11	13	24
Maryland	3	4	2	1	—	10	4	14
M'ss'chusetts	4	116	113	142	182	557	283	840
Michigan	—	1	3	1	—	5	4	9
Minnesota	—	—	—	1	2	3	5	8
Mississippi	1	—	—	1	—	2	4	6
Missouri	2	—	2	2	—	6	7	13
Montana	1	—	—	—	—	1	1	2
Nebraska	—	—	1	1	—	2	4	6
N'w H'pshire	—	2	2	6	5	15	12	27
New Jersey	—	—	3	5	4	12	6	18
New York	2	12	9	9	19	51	55	106
No. Dakota	—	1	—	1	—	2	1	3
Ohio	—	2	6	3	4	15	18	33
Oregon	—	1	—	—	2	3	5	8
Pennsylvania	2	3	4	7	5	21	16	37
Phil. Islands	—	1	—	—	—	1	3	4
Porto Rico	—	—	1	—	2	3	5	8
Rhode Island	2	6	1	3	5	17	10	27
So. Carolina	—	—	—	—	—	—	1	1
So. Dakota	—	—	1	—	—	1	2	3
Tennesee	—	1	1	1	—	3	2	5
Texas	—	4	—	2	1	6	7	13
Utah	—	—	1	—	—	1	2	3
Vermont	1	—	—	1	1	3	3	6
Virginia	—	4	3	—	—	7	5	12
Washington	—	1	2	2	—	5	4	9
W. Virginia	—	—	1	—	—	1	2	3
Wisconsin	2	2	—	2	1	7	2	9
Total	31	185	183	203	258	860	544	1,404
Foreign Countries.								
Argentina	—	—	—	—	2	2	3	5
Australia	—	—	—	1	1	1	1	2
Brazil	—	—	—	1	—	1	1	2
Canada	4	2	2	2	1	11	7	18
Chile	—	—	1	—	1	2	1	3
China	—	—	3	5	13	21	6	27
Costa Rica	—	—	1	—	—	1	—	1
Cuba	—	—	—	1	1	2	3	5
Denmark	1	—	—	—	—	1	—	1
Ecuador	—	—	—	—	1	1	—	1
Egypt	—	—	—	1	—	1	—	1
England	—	—	—	—	1	1	—	1
Finland	—	—	—	—	—	—	1	1
France	—	—	1	—	—	1	1	2
Germany	—	—	1	—	—	1	—	1
Honduras	—	—	1	—	—	1	2	3
Italy	—	—	—	—	—	—	1	1
Jamaica	—	—	1	—	—	1	—	1
Japan	—	1	—	—	—	1	3	4
Mexico	—	1	1	2	2	6	3	9
New Zealand	—	—	—	—	—	—	1	1
Norway	—	—	—	—	—	—	1	1
Paraguay	—	—	—	—	—	—	1	1
Peru	—	1	1	—	—	2	—	2
Russia	—	—	—	—	1	1	1	2
Switzerland	—	—	—	1	—	1	—	1
Syria	—	—	—	1	—	1	—	1
Transvaal	—	—	—	—	1	1	1	2
Turkey	—	—	—	1	1	2	—	2
Total	5	6	12	16	25	64	38	102

Residence of Massachusetts Students.

County.	No. of Towns.	No. of Students.	County.	No. of Towns.	No. of Students.
Barnstable	3	5	Middlesex	31	233
Berkshire	4	11	Nantucket	1	2
Bristol	6	23	Norfolk	20	95
Dukes	3	4	Plymouth	15	36
Essex	26	118	Suffolk	4	258
Franklin	2	2	Worcester	14	24
Hampden	6	25			
Hampshire	4	4	Total	139	840

From Cities which Send Five or More Students.

Boston	238	Winchester	10
Newton	41	Wakefield	9
Cambridge	29	Beverly	8
Brookline	27	Salem	8
Malden	20	Taunton	8
Lawrence	18	Weymouth	8
Newburyport	18	Fall River	7
Somerville	17	Haverhill	7
Quincy	16	Holyoke	7
Lowell	15	Braintree	6
Springfield	13	Needham	6
Everett	12	Watertown	6
Framingham	12	Bridgewater	5
Melrose	12	Hyde Park	5
Waltham	12	Manchester	5
Chelsea	11	Marlboro	5
Lynn	11	Revere	5
Medford	11	Woburn	5
Brockton	10		

Distribution of Massachusetts Students, above the First Year, Among the Courses.

Year.		Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Science.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Electro-chemistry.	Total.	
4th Year	Reg.	22	24	5	3	6	25	1	1	–	14	11	–	1	–	3	116
	Sp.	9	4	6	10	4	9	1	–	–	3	–	–	1	–	1	47
3d Year	Reg.	23	20	5	4	3	26	3	2	–	17	7	–	1	2	–	113
	Sp.	22	9	16	9	2	13	4	1	–	5	8	–	2	–	2	93
2d Year	Reg.	32	26	13	5	7	18	2	–	–	24	3	–	2	–	12	142*
	Sp.	14	17	10	18	4	16	–	–	–	15	2	–	2	–	2	100
1st Year	Reg.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	182
	Sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	43
Total	Reg.	77	70	23	12	16	69	7	3	–	55	21	–	4	2	15	371* 836*
	Sp.	45	30	32	37	10	38	4	1	–	23	10	–	5	–	4	240
Totals		122	100	55	49	26	107	11	4	–	78	31	–	9	2	19	611* 840*

* Deducting names counted twice.

WALTER HUMPHREYS,
Registrar.

Reports of Departments.

DEPARTMENT OF CIVIL AND SANITARY ENGINEERING.

During the past year the number of the Instructing Staff has remained unchanged. Of the eight Assistants three have remained, five have left and their places have been filled by Messrs. Carroll R. Benton, Walter K. Brownell, Eldon S. Clark, Ralph W. Horne, and John P. Wentworth. Mr. Horne and Mr. Wentworth are graduates from the Course in Sanitary Engineering, the first to be selected, as I remember, from this Course. While the numbers in this Course are not yet large, it may be of interest to state that in each of the three States of New York, Minnesota and Kentucky, the Chief Engineer of the State Board of Health is a graduate of our Course in Sanitary Engineering. Of the Assistants who have left, two have entered the engineering departments of two New England railroads; Mr. Henry B. Alvord continues in teaching, having been appointed Instructor in Surveying, Descriptive Geometry, and Geology at Bowdoin College, taking the position made vacant by the resignation of Professor Hudson B. Hastings, '07, who left to enter into business; Mr. Richard L. Cary has become Instructor in Mathematics at Princeton University; Mr. Howard B. Luther, after serving two years as an Assistant, is in Europe intending to devote two years to advanced study in engineering, and at this time is in Weimar. He goes as Russel fellow, the first beneficiary under the Richard L. Russel fund, and the first Civil Engineering graduate to pursue studies abroad under any form of Institute Fellowship or Scholarship.

During the year Mr. Warren C. Taylor, '02, has received an appointment from Union College as Instructor in Civil Engineering; Mr. Fred K. Merriman, '94, has been engaged by the Catholic University of America to take charge of the Civil Engineering work there; Mr. Walter A. Gleason, '97, has become a member of the instructing force at The University of Washington and Mr. Phelps N. Swett, '07, who has been an instructor in Mathematics at Middlebury College, has become an Assistant Professor of Mathematics and Civil Engineering. The demand for our graduates for educational positions is far greater than the available supply adapted to the work.

The new scheme of organization of the Department has worked satisfactorily. In Surveying and in Railroad Engineering no changes in personnel have been made except that the requirements of other departments have increased the demand for instruction in Hydraulics to an extent that made it seem necessary that Professor Russel should be relieved from duties both in Railroad Fieldwork and in Structures, with the outcome that each of the Associate and Assistant Professors and both the Instructors have their duties confined to one special sub-department, viz:— Hydraulics, Structures, Surveying, or Railroads, reporting directly to Professors Porter, Spofford, Robbins, or myself. The eight Assistants also are assigned, two to each of the four sub-departments, except that for Fieldwork in Surveying and Railroads the services of all the Assistants are required. The organization thus becomes very compact, more so than in earlier years. The efficiency of organization of a department, however, is secondary to the teaching efficiency of its members, and it is traditional in the Department that its members are thoroughly interested in the teaching side of their work as well as in the engineering involved. With a view in part to instilling and maintaining that interest, there have been held three informal dinners and meetings to which all the members of the De-

partment were invited, including the Assistants, and at which subjects were discussed in which the Assistants could be expected to take an active interest, and to the discussion of which they could bring valuable information or opinion. These meetings were successful from several standpoints.

The number of graduates from other colleges who come both into our fourth-year class and to take graduate courses, shows that there is a satisfactory recognition of the opportunities offered in the courses both in Civil Engineering and in Sanitary Engineering. The demand at present appears to be strongest for work along structural, hydraulic, and sanitary lines. The number of students taking advanced work has been larger last year and this than ever before; and it is becoming a tax upon our physical faculties to provide for them. Another year will probably find students taking advanced railroad work as well, and for this the Department is prepared. Several years ago there was a Geodetic Option for undergraduates, which was selected by a small number of students, who have done excellent and important work. It was thought, doubtless wisely, that the course was better adapted for a Graduate course, and the Department is still well qualified to do work of this kind. There exists a most excellent field for the limited number who are likely to pursue this course.

The size of the third-year class in Civil Engineering is greater than at any previous time, and suggests that another year may test the capacity of our drawing rooms to their utmost, and may render it essential that a special drawing room be found for the use of students taking advanced work.

The work of the Department has been broadened somewhat during the year by the addition of a course in Structures for fourth-year students in Electrical Engineering. The Department welcomes the opportunity to offer instruction in this or other fundamental subjects to students

in other departments, but it should be recognized that the conduct of such additional work adds a material burden to the work already required of the Instructing Staff, and the addition of any further courses along this line will necessitate an increase in the Civil Engineering staff.

During the summer Professor Spofford, in company with Professor Jaggar of the Geological Department, made an extensive trip through Central America. The prime object of this trip was to study the different forms of building construction with reference to their relative resistances to the earthquake shock of May 4, 1910, which resulted in the destruction of the city of Cartago, Costa Rica; the study of this question was made more effective by examination of structures and conditions in other parts of Central America. The Canal zone at Panama was also visited, and a thorough inspection made of the work in progress there. This trip was suggested and made possible by officials of the United Fruit Company, whose courtesy is greatly appreciated by the Department.

As usual during the summer nearly all the members of the Instructing Staff have been engaged in the active practice of their profession. Among the more important undertakings with which members of the staff have been connected, either as consulting engineers or which they have directly conducted, may be mentioned the apportionment of the cost of Craigie Bridge; an investigation and report upon the hydraulic capabilities and resources of the Blackwater district in New Hampshire; and the preparation of plans for the abolition of grade crossings in an important New England city,—projects involving an expenditure of upwards of four million dollars. It is believed that this intimate contact between teaching and practice is of great advantage in giving our instruction a breadth of view which could hardly be acquired otherwise and which adds much to the interest and value of the instruction.

The urgent necessity of the Department is the Summer Camp and School for study and practice in Surveying, Hydraulics, and Railroad Engineering. For several years the importance of this project has been presented in these reports. It has met the approval of the Faculty, and only the financial inability of the Institute has, I believe, stood in the way of putting it into effect. The interest of former graduates from the Department has recently been enlisted in this matter, and there is reason to hope that a way will soon be found to finance the undertaking.

The direct work of instruction by the Department has been valuably supplemented by the Civil Engineering Society carried on by the students in Civil and Sanitary Engineering. Meetings have been held about once a month at which papers of interest have been presented by engineers in practice and others. In November, the Grade Crossing Elimination Work at Malden and at Somerville was described by the Resident Engineers, Messrs. Lawton and Hadley after the students had visited this work and also similar work at Lynn; in March, Mr. H. L. Coburn, '98, spoke on Dams and Power Houses, a specialty of the Company with which he is engaged as Chief Engineer; in March, Mr. Joseph H. O'Brien, Resident Engineer, described important features of the new Pennsylvania Station in New York City; in May, Mr. J. H. Gregory, '95, explained the Sewage Disposal Problem of Columbus, Ohio, of which he had charge; in October of this year Mr. L. K. Rourke, Superintendent of Streets of Boston, talked about the Panama Canal, with the construction of which he was recently prominently connected; in May, Mr. S. E. Thompson, '89, explained "Some Failures of Concrete Construction," a line in which he has specialized; in December, 1909, Professor Henry Fay talked about the Failure of Steel, in investigating which he has recently found some very important facts. In somewhat more general lines Professor Swain, '77, spoke of Professional Ethics;

and Roger W. Babson, '98, on Business Barometers. The Students' Engineering Society has also carried on several excursions, among them a trip to a signal tower near one of our large stations. The Department conducted a similar excursion to a new signal plant of the Boston and Albany Railroad near Westfield, and also visited the locomotive shops at Springfield, where every courtesy was shown.

In addition to the opportunities offered at the meetings of the Students' Society, the Boston Society of Civil Engineers has during the past year extended the courtesy of inviting to its monthly meetings the members of the Students' Civil Engineering Society.

Gifts and other courtesies have been received from a number of corporations and individuals during the year, for which the Department desires to express its appreciation.

C. FRANK ALLEN.

DEPARTMENTS OF MECHANICAL ENGINEERING AND APPLIED MECHANICS.

Since the date of the last report the following gifts and loans have been made to the Department:—

A Moscrop single-thread yarn testing machine which will be especially useful in connection with the investigations upon the variations in the strength of cotton yarns, by the Draper Company of Hopedale, Mass., a gauge tester having a capacity of 2,500 pounds per square inch, by the Ashton Valve Company; a rock drill, by the Wood Drill Works of Paterson, N. J., an Ellison draft gauge, by Mr. Ellison; an extensive set of blue prints of governors for water wheels, by the Lombard Governor Company, of Ashland, Mass.; apparatus for making experiments upon the performance of aëroplane propellers, by Professor William H. Pickering. A forty horse-power automobile

power plant has been loaned by the Knox Automobile Company of Springfield, Mass., which is useful for experimental work on automobile engines. The Schutte & Koerting Co. have recently informed me that they are going to present to the Department a "Multi-Jet" ejector condenser, of a capacity suitable to handle the flow of exhaust steam from an 8-inch pipe.

The following apparatus has been loaned to the Department for use in the instruction in drawing:—

A No. 2 plain milling machine, by the Kempsmith Manufacturing Company of Milwaukee, Wis.; an 18-inch crank shaper, by the Stockbridge Machine Company of Worcester, Mass.; a 5-inch x 5-inch gasolene engine, by the Teele Manufacturing Company of Medford, Mass.

The class of 1910, having been the first to enter since the changes made in the course three years ago, was the first to derive the full benefit, with the result that we have been enabled to make many improvements in the instruction in addition to the constant development that takes place in our work from year to year.

As usual, the number of opportunities for employment has so far exceeded the number of graduates that each one has had several positions from which to choose.

The apparatus in the blue print room has been modernized. A part of the Cotton Laboratory has been fitted up for conditioning and testing yarn. The apparatus installed at present consists of a conditioning oven entirely surrounded by steam of atmospheric pressure, a similar oven in which weighings can be made, a yarn reel, a device for measuring the length of reeled skeins, a twist counter, and a Moscrop single-thread yarn testing machine (already referred to). It is hoped soon to add other weighing and testing machinery and to partition off a space in which atmospheric conditions can be controlled. The work so far accomplished has been the testing of yarns for variations in counts and strength.

As usual, a considerable amount of investigation has been and is being performed, in the laboratories of the Department. In many cases some problem which has arisen in the business of some firm has been the subject of investigation, and in most of these cases the firm has either provided the material used, at its own expense, or furnished facilities, or set up the apparatus necessary. In others the purpose has been the investigation of some industrial problem of general interest in engineering, or it has been performed upon some stage of an investigation which, when completed, will be of value in solving engineering problems.

Of the thirty-seven theses performed by the fifty-seven members of the class of 1910, eleven were of the first kind and eighteen of the second. Among investigations that were carried on last year and those that are now being carried on, the following will be especially mentioned:—

1. A thesis performed by two members of the class of 1910 and being carried further by a member of the class of 1911, had for its object to aid a committee of the American Society of Mechanical Engineers to devise and recommend a standard system of interchangeable involute gears, in coöperation with a similar committee of the British Institution of Mechanical Engineers. This investigation was undertaken at the request of the Chairman of the committee and the apparatus and gears were furnished by the members of the committee.

2. A thesis undertaken by four members of the class of 1910 involved the solution of a complete water power problem, the results of which were desired by the McElwain Shoe Company. It necessitated (1) the making of a contour map of the area to be covered by the back water, (2) the selection of a suitable site for a dam, (3) the determination of the storage capacity, (4) a tabulation of the data giving the flow of water in the stream for many years, from which to deduce the size of the storage basin; also the design of the dam, of the power house, of the penstocks, etc., to make the outfit complete.

3. One of the investigations was upon the use of spray nozzles instead of cooling towers, a subject that was in its infancy when the investigations upon the matter began at the Institute. Quite a number of men have come here to study the results of these tests, as they are considering the use of spray nozzles in their practice.

4. Another thesis had for its object the investigation of the distribution of power, steam, and the cost in coal of the manufacture of water gas. The work was of a high order and a very complete analysis was made of the plant, determining the amount of steam, air, coal, etc., used in the different parts.

5. A thesis of which the experimental work has already been completed by a member of the class of 1911, was undertaken because a former graduate of the Institute (who is now engineer of tests on a railroad) desired to make immediate use of the results of tests to determine the relative value of about a dozen different kinds of coal for use on locomotives. This work involved the making of many tests in actual service each run being of about 102 miles length.

6. A number of theses were performed upon different portions of the problems arising from the use of reinforced concrete.

7. A thesis is being carried on by a member of the class of 1911 having for its purpose to determine the fluctuation in position of the center of pressure of various surfaces for use in aëronautics, when placed at different angles to the direction of the wind.

The Mechanical Engineering Society conducted by the students of the Department has been affiliated with the American Society of Mechanical Engineers thus giving the students many advantages, such as the privilege of attending all the meetings of the Boston section of the American Society, also the receipt of a certain number of copies of the papers presented before the American Society (in

advance of their presentation) the recognition of the Students' Society in their publications and the reduced rate at which individual members can obtain the "Proceedings." The Students' Society has held a number of interesting meetings, at some of which addresses upon engineering subjects have been given by practicing engineers, while at others the students themselves have presented papers. They have also organized and carried on numerous excursions to various works.

The most pressing needs of the Department are:—

A refrigerating plant to enable us to make investigations along the lines of a most important industry; a gas producer plant to enable us to study experimentally a process that has already come into extensive use; an impact testing machine to enable us to make investigations the results of which are very much needed in connection with many problems affecting the strength of materials; a larger supply of apparatus for making experiments upon the effect of repeated and alternated stresses.

Inasmuch as the art of aviation has developed to so great an extent during late years, it is important that we should do our part in aiding its development, and hence that we should arrange for instruction and investigation in this field. By so doing we can also aid in preventing loss of life due to accidents that could be avoided were there more exact knowledge of the underlying principles and their application. It appears to me that the greatest need at the present time in this field is experimental research, especially in regard to efficiency and stability. For this work we need a large blower to produce a current of air, a motor to drive the blower, and a tube nine feet square to conduct the current to the surface to be experimented upon, together with the necessary auxiliary apparatus to enable us to make experiments upon the lift and drift, the motion of the center of pressure and the stability of surfaces suitable for aëroplanes, placed at different angles of inclination

to the current and subjected to currents of different velocities.

This apparatus could be used for thesis work of undergraduates interested in the subject; for research work by graduates and if the means could be found to employ a suitable man to devote his entire time to researches along these lines, it would furnish him the apparatus with which to work.

If the means cannot be found with the present resources of the Institute it would seem that the widespread interest in the subject might enable a special donation for the purpose to be obtained.

I will add that small apparatus of this character in which the speed of the air current is only sixteen miles per hour, and the cross-section of the tube only three feet square, was installed in 1896 and has been employed from time to time for the prosecution of thesis work. This small apparatus, while it has furnished results of value, is inadequate to deal with the problems demanding solution at the present time. For the testing of motors for aëroplanes, as well as for the testing of motors for automobiles, we shall be well equipped if a certain room 27 x 60 feet, the need of which has been called to your attention, can be enclosed and provided with a roof and concrete floor. The cost of this is not great. For the testing of propellers we have already some small apparatus, and the addition of larger will not be very expensive. If, therefore, the large blower, a motor, tube, and accessory apparatus can be secured through special donation or otherwise, we shall have acquired an apparatus for researches in this field better than any now existing, and shall have laid a solid foundation for any special courses that it may be deemed advisable to add in the future.

It would be well to secure occasional short series of lectures from men who have had considerable experience in flying, and in building successful flying machines, and

attendance upon these lectures should be optional on the part of any student. The subjects for these lectures would be such as "History of Aëronautics," "Movements of the Air," "Design of Flying Machines," etc. Any other courses should be arranged for graduates only, as the successful constructor of flying machines should be primarily a mechanical engineer.

A large part of such a course for graduates, if and when developed, should be devoted to research, and the remainder to the design and construction of flying machines. While considerable of this instruction could be given by members of our present staff, for other portions there would be needed the services of a man entirely competent from an engineering point of view, and who had had extensive experience along these lines.

More room is needed to relieve present crowding, to carry on thesis work upon apparatus brought in from outside, and to provide storage room for large and miscellaneous apparatus used upon thesis work conducted away from the Institute. More room and apparatus are also needed for the making and storing of large reinforced concrete beams and columns, inasmuch as many of those which we test at present have to be built outside of the Institute and are liable to be injured in transportation. Room is also needed for stripping machines for the purpose of Machine Drawing.

In the report of January, 1908, was also explained the need of a certain number of special assistants of the grade of Instructor, for the purpose of carrying on prolonged investigations and to prepare for publication not only their results, but also those of other investigations made in the laboratory.

GAETANO LANZA.

DEPARTMENT OF MINING ENGINEERING AND METALLURGY.

The year in the Mining Department has been a prosperous one. The student numbers are keeping up. The laboratories, although crowded to desperation, are still giving satisfaction to students and turning out researches of interest all over the world.

New Equipment.—A large number of split shovels and pans have been procured for the use of both the third and fourth-year classes. These are to be kept in the supply room and served out to students desiring them. The split shovel or fork with little troughs as prongs retaining and discarding alternately the fine ore poured upon it is the most accurate known device for sampling ores. A new Hunter's sifter has been installed for use in sifting and mixing ores, fluxes, etc., preparatory to sampling and assaying. A mechanical sieve designed by Professor Bugbee has been fitted up in one corner of the laboratory for use in sifting large quantities of very fine material, replacing the tedious operation of sifting by hand, using small sieves, when preparing samples for class work. We have added two new assay balances. This makes six new assay balances altogether. There still remain eight balances which are in poor condition and should be replaced whenever opportunity offers. The screw feeder used in the lead concentrating run has been rearranged and is now doing satisfactory work.

The jigs have been rearranged so as to work in a more logical order. Discharges have been installed on all sieves. The Johnston vanner installed a few years ago has been worked over and its speed regulation changed by gears, so that now it conforms to the requirements of our laboratory work. For the Wetherill magnetic separator, new take-off belts were secured from Denver to replace the

old belts which were a constant source of trouble. These are the standard belts used on the large Wetherill machines, and are giving good satisfaction. A tool post grinder has been purchased and is proving to be a very efficient machine for truing up rolls of both patterns and for taking down other metal surfaces which are too hard to be turned in a lathe. One larger and two smaller porcelain pebble mills have been supplied for purposes of fine grinding either dry or in cyanide solution, and are proving a valuable addition to the laboratory methods. Two new electric resistance furnaces wound with Excello wire instead of platinum, have been built by the Department and are enlarging the field of work. A Wilson-Maeulen millivoltmeter and a Siemens & Halske recording galvanometer have been supplied for Professor Hofman's work. A new horizontal grinder and polisher has been fitted up by the Department for preparing metallographical specimens and is proving more satisfactory than the old style vertical machine.

Instructing Staff.—The only changes this year have been in the Assistants. Mr. Thomas G. Chapman remains another year as Assistant in Ore Dressing, Messrs. Edward T. Almy, Jr., Henry R. Batcheller and Frederick Jaeger have left, and the services of Mr. Harold R. Perry and Mr. Bert S. Wohlgemuth have been secured. The new course scheme enables the work to be done with one less assistant.

Course Scheme.—The new scheme adopted two years ago has now come into use for all classes and it seems to be working out very well indeed. Under the new scheme it is found that Option I. or the general option, attracts the large number of students, which as the Department feels, is as it should be. Some progress has been made toward a summer school of surveying. This year, for the first time the changes in the Course will bring the Assaying for Course III. into the second term along with Thesis work and Assaying for Course XIV. This is a disadvantage which may be

overcome later. Course XIV. has not yet been able to transfer Assaying to the first term but it is hoped that they may do so soon, and thus save duplication of work The courses in Elementary Metallurgy and Electro-Metallurgy are now discontinued, the ground being covered by the course in Applied Electro-Chemistry. A new Course on Metallurgy of Engineering Materials is given in the second term to Course XIII. The Course in Metallography has been rearranged to allow more lecture hours.

Advance Students and Undergraduates.—Mr. J. A. Grant who was with us last year, finished up his work in June having made an investigation of coal dust as an agent in coal mine explosions and having discovered apparently some new points. There are no candidates for advance degrees in the Department during the present school year. Mr. Ove Collett is taking special work without expectation of a degree. He came to us from the Polytechnic School of Dresden, Germany. The fourth-year class in mining engineering and metallurgy numbers about twenty, the third and second years each about thirty.

Summer School.—After the omission last year of the summer school owing to the large number who took summer work instead, an interesting and profitable summer school in mining was held this year in Minnesota at Lake Superior and in Canada. At Niagara the party visited a power plant, the Acheson Graphite Company's plant, a wood pulp mill, and took the gorge route trip. At Ashtabula, while waiting for the sailing of the steamer, the great ore-receiving docks were visited together with the unloading devices which work with such wonderful speed. Here the party numbering eleven, embarked on the *Daniel J. Morrell,* Captain P. L. Millin, a superb ore boat, six hundred and two feet long, and were the guests of M. A. Hanna & Co., for three and one-half days, and a more delightfully satisfactory trip rarely happens. Going through the Sault Ste. Marie they saw the immense loading docks; they

visited the monster open mines worked by steam shovel at Coleraine and Hibbing, and the underground mines at Chisholm.

The next move was to the Michigan district of native copper mines. Here the students were given every facility for study at Calumet and Hecla, at Quincy and at Baltic Mines and Mills. They also visited the Calumet Smelter. Then by boat to the Sault Ste. Marie and to Sudbury Ontario, where the Creighton Mine was visited and the Crean Hill Mine. The smelter was also studied here. Next the party went to Cobalt, Ontario, where they visited Temiskaming Mine, Nova Scotia Mine, Crown Point Mine, Coniagas Mine.

At all the mines, mills and furnaces the students were treated with the greatest kindness and consideration through the influence of the officers of the several companies. The school occupied a little over four weeks and cost each man about $130.

Positions for Graduates.—As in former years, practically all the graduating class who were free to take the positions offered were able to secure work without delay. There have been two or three older men who have been out of employment and not able to secure work quickly. The demand which comes to the Department is more frequently for the young graduates than for men of a few years' experience.

Professional Work.—Professor Richards spent most of the summer in Ontario, Michigan, Montana, Utah, Colorado, and Missouri in studying and making improvements in concentration. He was retained as expert in three patent cases.

Professor Hofman was appointed by the Secretary of the Treasury to investigate the losses in lead endured in the smelting of lead ores and the refining of base bullion, with a view to levying the right amount of duty upon ore and bullion imported into the United States for treatment.

He visited the works of the American Smelting & Refining Co., situated at Perth Amboy, N. J., South Chicago, Ill., El Paso, Texas., and the smelting and refining works of the Balbach Company at Newark, N. J. The report made upon this investigation has been accepted both by the United States Treasury and the smelting companies interested. On his way to El Paso, he stopped over at St. Louis, and made a study of the works of the St. Louis Smelting and Refining Company, and the Federal Lead Company. He has also been retained as expert on the lawsuit of the Pitcher Lead Company, *v.* the St. Louis Smelting & Refining Co. He has devoted all his spare time to the preparation of his book on metallurgy. Professor Charles E. Locke visited in a professional way a gold property in Korea helping to settle important questions and getting much good experience. Professor E. E. Bugbee is preparing notes for his assaying class.

Mr. Hayward with Mr. W. T. Hall has finished the translation of Borchers' "Hüttenwesen." He has also become one of the abstractors for the American Chemical Society. Mr. Henry R. Batcheller made use of the laboratory for extensive research on a cement problem.

Visitors.—We have had large numbers of visitors during the past year. Perhaps the most noted being Baron Mitsui and Dr. Dan and their party. There have been also several other Japanese and a large number of former students.

Need of Space.—It seems hardly necessary to speak of this again this year. The condition has now become chronic. This is our most pressing physical want. We ought to make such an appeal, and put our case so strongly, either in this report, or elsewhere, that when a move is made, the Mining Department will be considered first. This equipment is a mere nothing compared with what we would like to add if space permitted. The main reason that we are not spending all of our appropriation is owing

to the fact that we have no place to put any new apparatus if purchased.

Gifts.—Professor Richards has from time to time given classifiers and jigs. Mr. Arthur W. Geiger has presented the Department with two assay balances. The drawings and technical papers of the late Charles O. Parsons, class of 1873, were given to the Department by his sister-in-law, Miss A. B. Hunter, administratrix of the estate. They form a valuable addition to the library.

ROBERT H. RICHARDS.

DEPARTMENT OF ARCHITECTURE.

For the course in Architecture, the year opened well, not only in the number but in the quality of the students. The registration, including second, third, fourth, and fifth years, numbers one hundred and fourteen,—the largest class in the history of the Department. Of this number twenty-six are graduates of colleges, twenty-five have had from one to three years of college training, and the remainder come from high and preparatory schools. The special students, of whom we have thirty-seven, make a very acceptable and important adjunct to our number. They bring with them the experience gained during two or more years in architects' offices; and have, perhaps, a greater appreciation of the practical value of a school training, and the influence of their presence is an additional stimulus on their less mature classmates.

The number of students who will enter the option in Architectural Engineering this year promises to be unusually large. Among them several, who have arranged their preparatory work at other institutions to fit them for this option, are entering with advanced standing.

The necessity for greater space to care properly for our classes is an old story, but is today greater than ever be-

fore. Some of our classes which, owing to complications of the tabular view cannot be divided into sections meeting at different hours, are so large that none of our class-rooms will accommodate them and they have therefore to be spread through two or three rooms, to the great disadvantage of their work.

The 1910 Traveling Fellowship of one thousand dollars was won by Mr. W. B. Kirby, '07, in competition with seven others. Mr. Kirby sailed for Europe the first of October, to follow a course of study laid down by the Department. I again call attention to the generosity of Mr. Guy Lowell which instigates this fellowship, and has thus far kept it going.

Mr. Ralph J. Batchelder, '08, holder of the 1909 Traveling Fellowship, has recently returned after spending a little over his year in Europe. He brought home many drawings accomplished during these twelve months, and a public exhibition of them has been held in our rooms. These drawings gave good evidence of the value of foreign study to one capable of profiting by it.

The Rotch Prize for the regular student in the Department of Architecture at the Institute was awarded this year to Mr. John H. Scarff; the Prize for the special student was divided between Messrs. Charles C. Clark and William E. Haugaard. Messrs. Scarff and Clark have returned for graduate work.

The Rotch Traveling Scholarship, which first requires from its candidates two years' practice in the office of a Massachusetts architect, and gives opportunity for two years' study abroad, again fell this year to an alumnus of Technology, Mr. J. McGinniss, '08. The beneficiary of this same scholarship two years ago, Mr. I. P. Lord, '03, has recently returned, and the walls of our exhibition room are at present completely covered with drawings of unusual interest made by Mr. Lord while abroad.

The two Boston Society of Architects' Prizes of fifty

dollars each were awarded to Mr. Reginald D. Johnson, a regular student, and Mr. John E. Kelley, a special student.

Professor Despradelle is this year a lecturer on Architectural Design at the School of Architecture of Harvard University. This does not interfere with his regular work here. On the contrary, it is to be hoped that the results may tend to a coöperation with our neighbor with the greatest profit to both.

Mr. Herbert E. Fowler, '10, is half-time instructor this year, helping mainly in Option 2. He is doing good service where it is greatly needed.

We are very fortunate in being allowed the partial services of Mr. L. Earle Rowe, Assistant in the Department of Egyptian Art at the Museum of Fine Arts, to help Professor Sumner in his course in European Civilization and Art. This opportunity has enabled Professor Sumner to require personal conferences from his students, and occasional visits by classes to the Museum for docent instruction, the consummation of a long cherished desire.

The opportunities offered by the Museum in its collection of classic models of figure and architectural sculpture is again for the first time since the removal of the Museum to be made use of by our advanced students in Life Class and Decorative Design. The Museum cannot be so freely used as when it was next door to us, but we believe that some alternation between work at our school and at the Museum will more than compensate in the broadening influences of the Museum for the time lost in going back and forth.

The first number of the fourth volume of the *Technology Architectural Record* will make its appearance in December. The usefulness of this publication has steadily gained in recognition by the architectural profession, and we believe that there has also been a steady gain in its general improvement from year to year. It is the only advertisement

of the Department of Architecture. It contributes to the general advertising of the Institute, and is, besides, sent as the regular Department circular, to prospective students in Architecture. The *Record* serves a good purpose, and our experience shows that the pecuniary assistance it receives from the Institute is at least counterbalanced in the tuitions returned through its influence.

I reiterate my regular appeal for a Travelling Fellowship in Architecture, and relief for the Department from its yearly struggle to get the necessary funds for this purpose. To a very great extent the success of our post-graduate course is dependent upon our ability to offer such a prize. It is discouraging to receive, as we have repeatedly done, requests from other schools to lay before our graduates statements of inducements which they offer, and with which we cannot compete, to come to them for the advanced degree and the opportunity of winning a fellowship for foreign travel; and it is humiliating to us that we are unable to create sufficient appreciation of our crying need to have it satisfied. There is not an architectural school in good standing in this country, excepting that of the Institute, that has not assured means of offering its students the opportunity to round out their school life with foreign travel, and yet the Institute's school is the oldest of them all.

F. W. CHANDLER.

CHEMISTRY AND CHEMICAL ENGINEERING.

The Department is able to state that the year covered by this report has been another of general prosperity, and, it is hoped, of progress as well. As stated below, the work of the Department imperatively demands that additional space shall be provided for it, and it has been able to do somewhat less during the year, as well as for a number of years past, than it would wish to do in the interests of all

concerned, because of the necessary limitations imposed by cramped and overcrowded quarters, but the members of the Department have made loyal effort to utilize efficiently the facilities at their command.

The personnel of the senior members of the Instructing Staff has undergone few changes during the year. Professor F. Jewett Moore has received deserved promotion to an associate professorship in Organic Chemistry and one of our most enthusiastic and earnest teachers, Dr. Ellwood B. Spear, has been appointed Assistant Professor of Inorganic Chemistry. As a result of increasing pressure of his duties as Director of the Research Laboratory of Applied Chemistry, Dr. Walker has found it necessary to ask for a partial relief from his instructional work, and the Department has been fortunate in securing the services of Dr. Warren K. Lewis (X., 1905) as Assistant Professor of Industrial Chemistry, who has taken the charge of the laboratory work in that subject. Dr. Lewis is also giving some advanced courses on chemical engineering topics.

Of the instructors, Dr. Fred H. Heath has resigned and his place has been filled by the appointment of Dr. Frederick G. Keyes, as Instructor in Theoretical Chemistry. Dr. Keyes is a graduate of Brown University. Of the assistants, six have resigned, and the new appointees are mainly from the last graduating class. Mr. Charles E. Peel, Assistant in Technical Analysis, is a graduate from the New Hampshire College. Mr. Royce W. Gilbert has been promoted to an Instructorship in Air and Water Analysis.

It is a pleasure to record that, through the liberality of Professor F. Jewett Moore, it has been possible to appoint two Research Assistants in Organic Chemistry, who work under his direction. These positions are held by Miss Ruth M. Thomas, of Simmons College and later associated with Bryn Mawr, and Mr. Richard R. Taylor of the class of 1910.

During the past year investigation work which is essen-

tially similar in its relations to the Department to that carried on in the Research Laboratory of Applied Chemistry has been conducted under the direction of Professor Mulliken, upon the improved utilization of certain dyewoods. It is a matter of much regret to the Department that this must soon be terminated on account of the stern necessity of utilizing the space occupied by this work for instructional purposes.

The Course Schedules of Chemistry and Chemical Engineering have also undergone some modifications during the past year. These schedules have previously required that the students should satisfy an entrance requirement amounting to two years each of French and German, and should then pursue a year of study of each language at the Institute. It is now proposed to require only the study of German after entrance, the purpose of the change being to secure a somewhat more complete command of the one and usually more difficult language. The students in both the Courses will hereafter present the same amount of French and German at entrance as formerly, but, in the Chemical Courses will take two years of German, and in the Chemical Engineering Course a year and a half of German at the Institute, the assignment of hours after the first of these years being somewhat less than the former assignment in each case. The net result is to lessen the total assignment to modern languages by forty-five hours in the Chemical and by one hundred and eighty hours in the Chemical Engineering Course. The time thus set free has been mainly distributed among the subjects already in the Courses with a view to increased thoroughness of instruction, rather than the introduction of new subjects. This has also made possible a distinctly advantageous rearrangement of the work in Physics and Applied Mechanics in the Course in Chemical Engineering and it is believed that both Courses have been materially strengthened by these changes.

The available space in the Laboratory of Air and Water Analysis has been slightly increased by the addition of a hanging balcony for the accommodation of thesis work, and a system of ozone generation has been installed, through the loan of an air ozonizer by the Ozone Engineering Company of Chicago.

On June 8, 1910, Dr. Thorp started from Boston with a party of sixteen students from the third and fourth-year classes for a series of visits to industrial plants. These visits continued for fifteen days, and were highly profitable for all who took part in the trip. The party, of which Professor Talbot was also a member, were most cordially received by the officials of the various plants, and were delightfully entertained by the Eastman Kodak Company, the Moorlbach Brewing Company, and Pratt & Lambert, Inc., and by the Technology Club of Rochester. The Institute and the Department is much indebted to all of those who, through their courtesy, contributed to the success of the trip. The plants visited were: Standard Sugar Refinery, South Boston; Windsor Print Works, North Adams, Mass.; Strong, Hewat & Co. (Woolen Mill), North Adams, Mass.; West Virginia Pulp & Paper Co., Mechanicville, N.Y.; American Hide & Leather Co., Ballston, N.Y.; Glens Falls Portland Cement Company, Glens Falls, N.Y.; Halcomb Steel Company, Syracuse, N.Y.; Onondaga Pottery Company, Syracuse, N.Y.; Reed Glass Company, Rochester, N.Y.; Pfaudler Company (Enameled tanks), Rochester, N.Y.; Stromberg-Carlson Company (Cables, etc.), Rochester, N.Y.; Eastman Kodak Company, Rochester, N.Y.; Moorlbach Brewing Company, Rochester, N.Y.; Carborundum Company, Niagara Falls, N.Y., Acheson Graphite Company, Niagara Falls, N.Y.; Niagara Falls Power Company, Niagara Falls, N.Y.; Canadian Power Company, Clifton, Canada; Larkin Company, (Soap, Toilet Articles), Buffalo, N.Y.; Standard Oil Company, (Atlas Refinery), Buffalo, N.Y.; Linde Air Products

Company, (Oxygen, etc.), Buffalo, N.Y.; Sowers Manufacturing Company (Foundry work), Buffalo, N.Y.; Spencer Kellogg & Sons (Linseed Oils), South Buffalo, N.Y.; Lackawanna Steel Company, South Buffalo, N.Y.; Buffalo Smelting Company (Copper), Buffalo, N.Y.; Pratt & Lambert, Inc. (Varnishes), Buffalo, N.Y.

In response to another request for the nomination of a second-year student to work in the laboratory of Harrison Brothers, Mr. Bates Torrey, Jr., of the Course in Chemical Engineering was recommended for their consideration and spent a profitable summer at their works.

Reference to the list of publications of the Department for the year will show that its members have not been idle. They have also responded freely to calls for public or semi-public service in connection with many societies and worthy objects. It is not inappropriate to point out anew that these services often involve a very considerable outlay of energy and that the attending expense can only be met by sacrifices which mean much as evidences of loyalty to the Institute and to the welfare of their profession and the community.

It was noted in the last Report that the number of students electing the Course in Chemical Engineering has notably increased. This increase has been still more marked during the last year, the number now registered in the second year alone being about sixty. The number of students entering this Course from other colleges has also increased this fall, and there has been a marked increase in the number electing the Course in Electrochemistry. While these changes are accompanied by a decrease in the number electing some of the other Courses, the aggregate is larger and, in particular, the number continuing in the more strictly professional chemical subjects is much larger than could have been anticipated. This condition of affairs seems likely to continue, in view of the awakening interest in chemistry throughout the country, and the

Department is called upon to face so difficult a situation with reference to the maintenance of its efficiency and even to the mere accommodation of these students, that a somewhat detailed statement seems imperative. There can be little doubt that the professions of the chemist and the chemical engineer are coming into increasing prominence and are likely to rank among the first in importance in the immediate future. The Institute should do its full share in the educating of men to meet the demand and obviously such work as we undertake must be well done. It is not too much to say that the maintenance of our present standard, or its advance, must be conditional upon the exclusion of desirable students from chemical subjects unless more space is at our command. Upon the basis of a reasonable assumption regarding the election of Courses by the members of the present first-year class, it is evident that the laboratories of Analytical, Organic, and Theoretical Chemistry, cannot accommodate the students entitled to enter these subjects next year. Other laboratories are much overtaxed. Some immediate relief must be afforded. There can be no wholly satisfactory solution of our problem except a new building for the departmental work. The Department stands ready, as it has for the past ten years, to subdivide its classes and devise ways and means to any extent compatible with proper instruction, but it should be remembered that all such expedients involve grave dangers of lessened efficiency, which are a menace to the welfare of our students.

Among the further urgent needs of the Department is the development of a Laboratory of Chemical Engineering, as a development of our present Laboratory of Industrial Chemistry. To do this demands increased space as well as a somewhat increased outlay. It is a line along which the Institute should advance if it is to render its full service to the industrial development of the country. Another real need is space for a Chemical Museum, a most valuable

adjunct to all instructional work. At present the Department is not only prevented from inviting gifts of material which would prove most useful to it, but has even been forced to decline offers because of utter lack of opportunity to meet the reasonable wishes of the donors with respect to exhibition or preservation. The difficulties arising from the distribution of the work of the Department among four buildings, and the loss of time consequent upon the long distances which the instructors have to cover in seeking recitation rooms in all of the buildings (much greater now than ever before) have been noted in earlier Reports, but are not less apparent today. The gratifying position of the Institute with reference to its staff of workers in Chemistry, as shown on a statistical basis by Dr. Cattell in *Science* (Nov. 11, 1910), is no doubt largely due to the work of the Research Laboratories, which have been established here, and to the liberal policy of the Institute with reference to Research Professorships and other like positions. There still exists, however, an urgent need for more adequate provision for research work by the junior members of the Instructing Staff in connection with their other duties. This work must always be the real source of life and inspiration in a scientific department and must be encouraged in all reasonable ways. At present much credit is due to those who pursue such work under great difficulties as to interruptions and inadequate space, and it is not only true that they deserve better things, but that the interests of the Department will be served by serving them.

The members of the Department unite in respectfully urging an immediate consideration of its position and its needs, that we may not only continue to provide for those desiring to work with us in a way befitting the traditions of the Department, but to advance with other institutions of the first rank.

H. P. TALBOT.

RESEARCH LABORATORY OF PHYSICAL CHEMISTRY.

The laboratory has been fortunate in retaining upon its research staff the group of competent investigators which it has had for a number of years. Dr. William C. Bray has been promoted to the grade of Assistant Professor of Physico-Chemical Research in recognition of his ability as an investigator and of his success in directing the researches of the advanced students and junior assistants. The staff has been strengthened by the addition to it of Dr. Frederick G. Keyes, formerly of Brown University, who is devoting his time partly to research work and partly to the undergraduate instruction in theoretical chemistry.

The number of men engaged in research work in the laboratory this year is fifteen, consisting of ten members of the staff and five candidates for the degree of Doctor of Philosophy. Nearly all the available places are now occupied and more room will be needed if there should be any increase in the number of graduate students.

The lines of research referred to in last year's report have been continued, and certain new investigations have been begun. Seventeen articles describing the progress made in these researches have been published in scientific journals.

Of the new lines of work undertaken may be mentioned the study of Professor Lewis on four-dimensional vector analysis; that of Professor Noyes on the application of the theory of indicators to volumetric analysis; the systematic critical review, begun by Dr. Falk, of existing data relating to the properties of aqueous salt solutions, considered with reference to the development of the Ionic Theory; and the investigations of Dr. Keyes on the dissociation pressure of potassuim and sodium hydrides and on the potentials of potassium and sodium electrodes against solutions of their ions.

The investigations in the laboratory have again been

assisted by a grant of $3,000 made to Professor Noyes by the Carnegie Institution of Washington.

The plan of instruction in advanced theoretical chemistry has been further systematized. The course, given in the form of a seminar, now extends through two years, and includes the discussion of six distinct topics, to each of which twenty exercises are devoted. During the consideration of the separate topics the seminar is conducted in turn by the three Faculty members of the staff.

A. A. NOYES.

RESEARCH LABORATORY OF APPLIED CHEMISTRY.

During the past summer, the large room which has heretofore been devoted to the work of the Research Laboratory, has been sub-divided, so that there are now four laboratories with complete equipment, each accommodating two men. These facilities, together with the use of the Laboratory of Industrial Chemistry when more extensive experimentation is demanded, place the Research Laboratory in a position to carry on its work with increased efficiency. All available space is, however, now filled, and work on a number of problems for which financial provision has already been made must for the present be postponed.

The investigation of certain difficulties incident to the manufacture of galvanized sheet iron which has been carried on by this laboratory for the past two years, has been completed by Mr. Raymond E. Drake, with gratifying results. Mr. Alcan Hirsch also has completed the work on a new differential condenser as applied to the mixed vapors of volatile liquids, commenced by Dr. Warren K. Lewis some time ago, and the same has been published. From the correspondence received from both the manufacturers and users of distillation apparatus it is evident that

this work will prove an important contribution to the subject.

The study of paints and varnishes as protective coatings for iron and steel, which was carried on in a highly satisfactory manner during the greater part of last year, was brought to a stop by the sudden death of Mr Maurice T. Jones, Jr., on May 25th. Not only was this investigation ended for the time but all the work of the laboratory received a check, for it was found that Mr. Jones' genius and willingness to help had pervaded the whole activity of the laboratory. The investigation of protective coatings has, however, been taken up where it was left by Mr. Jones, and together with some phases relating to the chemistry of linseed oil is being carried out by Mr. Walter C. Slade as post-graduate work.

The laboratory is still engaged upon the study of the production of glycerine from sources other than fats and oils, which was commenced last year. The work is under the immediate charge of Dr. Lothar Weber and will be continued throughout the present year.

The new investigations undertaken this fall include the study of the properties of wool grease with a view to adapting this material to uses other than those for which it is now employed; this is being conducted by Mr. Raymond E. Drake. Charles Almy, Jr., is investigating the deterioration of the palm oil used in the tin plate industry. It is hoped that this heavy waste of valuable material can be greatly reduced. Mr. Alfred W. Burnham is continuing the study of the factors influencing the efficiency of ball and pebble mills, commenced as an undergraduate thesis last year by Mr. C. E. Meulendyke. We are being aided in this work by a number of both the manufacturers of and the users of mills of this type. An investigation of electrical insulating materials capable of withstanding molten iron is being made by Mr. Charles P. Randolph. The desirability of having such material has long been recognized

and results already attained make it certain that the investigation will prove of considerable interest. Messrs. Walter A. Patrick and Walter Arthur, the latter as a part of his post-graduate work, are making a comprehensive study of the structure of zinc-covered iron with a view to obtaining a more adherent as well as a more durable coating.

The laboratory has again been aided on the financial side by a substantial gift from Mr. Charles W. Hubbard of Boston. The E. B. Badger & Sons Co., has presented the Department with a very complete copper still, with rectifying column and condenser.

Dr. Warren K. Lewis, who last year as non-resident Research Associate rendered the laboratory great service, is now Assistant Professor of Industrial Chemistry at the Institute and continues to be closely associated with the work of the laboratory.

WILLIAM H. WALKER.

DEPARTMENT OF ELECTRICAL ENGINEERING.

The Electrical Engineering Department continues in paths outlined in my preceding reports.

Careful efforts are being made to prevent the promotion from the lower classes of any except competent students, but the numbers of students in the third and fourth-year classes of the Undergraduate Course are increasing. The third-year class receives a considerable number of Arts and Science graduates from colleges, who enter the Institute as a rule with the third-year rank.

The progress of the advanced work of the Department is indicated by the increase in the number of students who are candidates for higher degrees. One degree of Doctor of Engineering (the first conferred by the Institute) was last year conferred on a student taking his major work in the Department, and the degree of Master of Science was conferred on two other students. The number of well-

prepared students pursuing graduate electrical engineering study and research in the Department is now greater than last year.

These circumstances emphasize the importance of increasing the number of class rooms and research rooms available for the use of the Department, as urged in previous reports.

The need of means for promoting in a more rational manner the younger men of our teaching staff is emphasized by the annual depletion of our list of instructors and assistants through their employment by commercial establishments and other educational institutions.

Mr. Edgar P. Slack resigned his position of Assistant in Electrical Engineering in January, 1910, to enter the research staff of the Carnegie Nutrition Laboratory. Mr. Frederick G. Perry, Technology '09, was appointed as his successor for the remainder of the year. At commencement time, 1910, Instructor George B. Thomas resigned to become a member of the staff of Colorado College and Instructor Evan J. Edwards resigned to go into commercial employment. Assistants Robert C. Glancy, George H. Gray and Isaac H. Van Horn also resigned to go into commercial employment. Messrs. Howard Agee, Pennsylvania State College '10, Chester L. Dawes, Technology '09, Loren N. Downs, Jr., Technology '10, Ralph M. George, Princeton '08 and Technology '10, Fred R. Lufkin, Technology '10, Frederick G. Perry, Technology '09 and Henry P. Thomson, Washington University '10 were given one year appointments as assistants. Mr. Perry occupied a similar position during the second term of last year, and Mr. Dawes was an assistant in physics last year.

The changes occurring in our staff each year on account of the desirable openings afforded to our younger men by commercial concerns and by other educational institutions seriously interferes with the continuity of instruction in our laboratories. Mr. Green is now the only one of the

staff in the important electrical engineering laboratory under Professor Lawrence's direction who has been in our teaching force more than a single term, and neither one of the assistants in the standardizing laboratory has been on the Department staff before. The staff of instructors and assistants is composed of most promising young men and it is of prime importance to find some way to improve the rate of promotion, so that we may retain more of the men for reasonably extended periods.

The manner in which commercial organizations have sought after our instructors and assistants and after the men taking our advanced degrees is an encouraging sign of the usefulness of the advanced instruction.

The increasing numbers of students in the Department laboratories will make it necessary to ask for additional staff for the next Institute year. The number of fourth-year Course VI. students in the electrical engineering laboratory is 15 per cent. greater than last year and the third year class, which comes into that laboratory next term, is also of increased numbers compared with last year. The Electrical Engineering Department staff now gives required lectures, recitations or laboratory instruction to students of many of the Institute courses in addition to Course VI.

A number of additions have been made to the equipment during the past year, mostly in the way of increasing the number of machines and instruments to meet the needs of increasing numbers of students, but in certain instances providing improvements in the laboratory processes.

Professor Laws has spent considerable time in perfecting the details of oscillographs built under his direction for the laboratory. He has also been working at improved processes of testing current-transformers, determining the phase angle in such transformers, and testing large, direct current watt-hour meters while subjected to fluctuating loads.

Other work of research now going on in the Depart-

ment (mostly under the direction of Professors Pender and Wickenden) relates to the effects of heat treatment on the magnetic qualities of silicon iron, the transient phenomena that may occur in long electric lines, the effect of high frequencies on the permeability of iron, the effective reactance and resistance of steel rails when conveying alternating currents, the selective action of spark gap lightning arresters with respect to frequency, and the reflection of light from walls and ceilings. Certain of these are continuations of work put under way last year.

The results of the thesis research of Dr. Harold Osborne, on whom was conferred our degree of Doctor of Engineering last June, were embodied in a paper presented before the American Institute of Electrical Engineers at its October meeting. The results of the thesis research of Mr. Laurence S. Winchester, on whom was conferred our degree of Master of Science last June, are also about to be published.

The curriculum of Course VI. has been improved by transferring the elementary electrical laboratory work from the third year to the second year, which is expected to afford the students a better preparation for the electrical engineering studies of the third year. This change is accompanied by a rearrangement and improvement of the instruction in electrical measurements.

The subject of illumination and photometry has been added to the subjects taught in the Department. This is treated from the standpoint of what is often called illuminating engineering, and is made an optional study in the fourth year of Course VI.

DUGALD C. JACKSON.

DEPARTMENT OF BIOLOGY.

The most important event in the Department of Biology during the year has been the resignation of Assistant Professor Charles-Edward A. Winslow and his removal to a new and inviting field of labor.

Professor Winslow began his connection with the Department as a regular undergraduate student in 1894, and graduated honorably with the Degree of Bachelor of Science in Biology in 1898. He remained at the Institute a fifth year for the purpose of taking the Master's Degree, and the thesis work which he did at that time was afterward published, in collaboration with Professor Sedgwick, as a special Memoir of the American Academy of Arts and Sciences,—a Memoir which is today regarded as the basic monograph in the Bacteriology of Ice and possibly in the interpretation of the seasonal distribution of typhoid fever. After some practical field work with the Board of Health of Montclair, N.J., and the State Board of Health of Massachusetts, Mr. Winslow joined the Staff of the Department and rose rapidly to the position of Assistant Professor of Sanitary Biology and Biologist-in-Charge of the Sanitary Research Laboratory and Sewage Experiment Station. In all of these relations, and in his teaching and his research work, he soon won distinction and came to be regarded as a worthy product of the Institute and of the Biological Department. Professor Winslow has published extensively, and his reputation as a lecturer and teacher caused him to be invited by the authorities of the University of Chicago to give, early in the present year, some of the Courses of Instruction ordinarily given by Dr. E. O. Jordan, Professor of Bacteriology in that University (himself an Institute graduate from the Biological Department in 1888) during the temporary absence of the latter,—the Executive Committee of the Institute kindly releasing Professor

Winslow from his regular duties for this purpose. In the spring he received an urgent call to the College of the City of New York, coupled with another to the American Museum of Natural History which was about to establish a new Department of Public Health, the organization of which would be placed in his hands. This double opportunity seemed so important as well as so attractive that he was reluctantly released by the Institute authorities, and entered upon his new duties in September of the present year.

To fill as far as possible the place left vacant by Professor Winslow, Mr. Selskar M. Gunn, another graduate of the Department, has been appointed to an Instructorship in Sanitary Biology. Mr. Gunn was graduated with the Degree of Bachelor of Science in Biology, in 1905. He spent the next year as Private Assistant to Professor Prescott in the work of the Boston Bio-Chemical Laboratory, and thus gained an intimate and extensive acquaintance with the problems of milk supply and the public health. He was then appointed Assistant Bacteriologist to the State Board of Health of Iowa, a position which he filled to the entire satisfaction of his superior officers, who received his resignation with regret when after two years he was appointed Health Officer of the City of Orange, N.J. In the two following years which he spent in Orange Mr. Gunn won so much distinction that when he resigned to come back to the Institute, a public dinner of city officials,—the first of the kind ever given in Orange,—was tendered in his honor, and a number of appreciative letters appeared in the public press recognizing his good work and regretting his departure.

Professor Sedgwick, having been granted leave of absence for the purpose, was absent from the Institute from March 20th to the end of the school year, but returned, invigorated, to resume his work at the opening of the present year. The intervening time was spent by him

largely in travel and in rest in Greece, Dalmatia, Italy, and England. He was also able to do some new work and to make observations and studies which should prove valuable in his future investigations and teaching.

One of the notable developments in the field for graduates and special students of the Department is the increasing demand for work and for workers in connection with Boards of Health and in Industrial Biology. This demand doubtless arises from the growing interest everywhere felt in public health problems and the increasing sensitiveness of the public to sanitary matters of all kinds. Especially is it becoming recognized that Boards of Health of modern communities should be something more than subordinate and mechanical portions of the local political organization, and in a number of cases local Boards of Health, which have hitherto shown hardly anything more than inactivity have roused themselves and invoked the aid of Institute graduates specially prepared in the Department of Sanitary Biology or Sanitary Engineering. There is evidence, moreover, that this demand is on the increase, a fact which is specially gratifying inasmuch as there is, perhaps, no way in which the Institute can today more effectively serve the public which supports it than by ministering to this particular need.

The applications of bacteriology to fermentation and refrigeration processes, are constantly increasing, while the widespread interest in pure foods and the practical application of the pure food laws are bringing forward many questions of manipulation, administration and even of litigation along these lines. The milk supply problem does not become simpler but, rather, increasingly difficult as times goes on and the public is becoming more educated and exacting; and it should be gratifying to all connected with the Institute to realize that in Professor Prescott and his associates we have capable and well-trained representatives of the various phases of this important subject. In

short, along every line,—Sanitary Biology, Industrial Biology, Industrial Hygiene, Parasitology, and general Sanitary Science and Public Health,—there is reason to believe that the Institute is holding its own in leadership and in influence in State and Nation.

All of these activities are, however, absolutely dependent upon the spirit of research and investigation, and that these springs of our knowledge are not running dry, but are abundantly fed by the scientific devotion, industry and enthusiasm of the various members of the Department Staff is proved by the list of publications which appears elsewhere.

WILLIAM T. SEDGWICK.

SANITARY RESEARCH LABORATORY AND SEWAGE EXPERIMENT STATION.

The work of the Sewage Experiment Station continues to have a wide and increasing practical usefulness. The most important sewage disposal plant constructed during the year,—that at Mount Vernon, N.Y.,—is equipped with distributors designed at the Institute Station, and the new type of septic or biolytic tank, originated here in the course of the last two years' experiments, is attracting wide attention. The most important and exhaustive review of the whole subject of sewage disposal hitherto published in America has appeared during the past year from the hands of three Institute graduates, and embodies many of the results of researches carried out at the Institute or by Institute workers since the foundation of the experiment station.

One of the three Institute graduates just referred to, Professor Charles-Edward A. Winslow, has been from the beginning of our work Biologist-in-Charge of the Research Laboratory and Experiment Station. The general plan of the work which has been so successfully prosecuted during the last eight years was mainly Professor Winslow's,

and to his ability, energy and inspiration should be credited the greater part of whatever success has been achieved.

The withdrawal of Professor Winslow from the Institute has thrown upon the shoulders of Professor Phelps and his associate, Mr. George T. Palmer, added responsibilities which they have cheerfully undertaken. The development of the arts of disinfection of water and sewage at the hands of Professor Phelps deserves special mention and reflects great credit upon him and upon the Sewage Experiment Station.

Much of the detailed work of the Station during the past year has been carried out by Mr. Palmer, whose services we have been fortunate in retaining.

An entire year has now elapsed since the transfer of the Experiment Station from Albany Street to the Calf Pasture and the results reached amply justify that change. The closer connection now existing between the Sanitary Research Laboratory and the other Institute Laboratories with the increased faciltites for experiment at the new Station are noteworthy, and no serious disadvantages have thus far appeared.

Mr. Palmer has well under way in collaboration with the Director a detailed investigation of the whole question of the sewage disposal of unsewered villages, hamlets, camps, farms, summer cottages, private estates, and the like, a subject of immense practical sanitary importance in a country like our own, which is still to a large extent rural or suburban.

The practical usefulness of a Laboratory and Experiment Station of this sort to the student body has now become very great, particularly because of the increasing number of students of Sanitary Engineering and Sanitary Biology. It is difficult to overestimate the value, for purposes of investigation and demonstration of the methods and aims of Sanitary Science and the sanitary conduct of domestic and municipal life, of actual appliances as demonstrated in an

establishment of this sort. As an educational asset the Laboratory and Experiment Station have abundantly justified their existence.

As these lines were being written an urgent appeal for aid came to the Station from a New England City in distress because of an impending water famine, to which appeal it was possible to make instant response, such as could not possibly have been rendered had no similar Laboratory and Station existed at the Institute. Stronger evidence of its practical usefulness and of the far-sighted wisdom of the anonymous donor it would be difficult to find.

The Director has repeatedly acknowledged the deep indebtedness of the Institute to the generosity of the donor but it is rapidly becoming evident that the public at large shares also in this indebtedness; and it is greatly to be hoped that a public which profits by these advantages shall lend a hand in bearing the financial burdens. If more money were available, more and better work for Science and for the Community could readily be done by the eager, enthusiastic and self-sacrificing attachés of the Sanitary Research Laboratory and Sewage Experiment Station.

WILLIAM T. SEDGWICK,
Director.

DEPARTMENT OF PHYSICS.

There have been no changes in the methods or subjects of instruction in this Department during the past year of such importance as to call for extended explanation, though we have been able to secure improvement in various details. The appointment of an additional instructor in Second-Year Physics a year since has made it possible to increase the number of recitation sections and thus to reduce their average size very materially. The exigencies of the tabular view, however, still necessitate more inequality

in this than is desirable. There are at present seventeen sections, and the number could be profitably increased without taxing the present instructing force were not this forbidden by the crowded state of our class rooms.

This need of more adequate class-room accommodations has been a crying one for a number of years past, since the gradual transformation of the recitation rooms in the Walker Building into chemical laboratories has rendered it necessary of late years to hold the class-room exercises in Physics almost wholly in other buildings, generally in rooms which have been primarily allotted to other departments, and in such rooms as chance to be vacant at the hours assigned, so that different rooms have to be used by the same section on different days. All this is necessarily somewhat confusing to the students, but what is of more consequence it renders it practically impossible to carry physical instruments to the class room, so that they can be studied by the students at close range.

The physical lecture rooms, Nos. 22 and 23, are still sufficiently large to accommodate the second-year class when divided into two sections as has been the case for a number of years past. The third-year class, however, has become so large that it considerably exceeds the possible seating capacity of No. 22, the larger of these rooms, and in the case of Professor Norton's lectures on heat, which are attended by all regular students of that year, it has become necessary to bring in settees in order to furnish a sufficient number of seats of any kind for about twenty men. The indications as to next year are such as to lead us to believe that without doubt there will be a still larger class to be taken care of. The introduction of settees and movable chairs or stools into a lecture room already somewhat constricted in area of passage ways is highly objectionable, not only because of the inconvenience, but also because the consequent obstruction of the passages involves an element of danger in case of fire or an alarm of any kind.

It will therefore be imperative next year to have the lectures in Heat repeated. The Committee which is charged with the arrangement of the tabular view is now considering what arrangement of hours can be made. The class thus divided into two sections can readily be accommodated in No. 23, which, however, will require some fitting up to adapt it to meet the particular needs of these lectures.

The most important change which has been introduced into the instruction in the Laboratory of General Physics during the past year is the extension of the course of general physical measurements in the second year so as to include experiments in electricity, a procedure which has long been desired by the Department. This has been accomplished in Courses VI., VIII., and XIV., by beginning the course in the middle of the first term and increasing the total number of assigned hours by fifteen. The laboratory instruction in Mechanics, Optics and Electricity is thus brought into close relation with the lecture and class-room work in these branches of Physics to the decided advantage of each.

The work for these Courses in the Electrical Laboratory will hereafter form a part of the course in general physical measurements under the direction of Professor Goodwin and Professor Drisko. Professor Laws, who has been in charge of the Electrical Laboratory for many years, and to whose devotion and skill it largely owes its recent progress, has been forced by the demands upon his time to relinquish this work and confine his attention to his duties in the Department of Electrical Engineering. The immediate work of instruction in general electrical measurements will, therefore, be undertaken by Mr. Page who will also take charge of the laboratory conferences which have been introduced into the second term of the second year in connection with the Electrical Laboratory experiments.

Following the recent revision of the schedule of Course X., work in the Physical Laboratory for all courses will

hereafter begin in the second year and be completed by the middle of the third year. Precision of Measurements is now included in the curriculum of all courses taking laboratory work except I. and XI. Owing to the very large second-year class and to the inadequate number of recitation rooms and difficulties of tabular view, it has become necessary to give this course by lectures to two large classes rather than by recitations to small sections as heretofore. Although this is not as serious a change as would be the case with many other subjects, owing to the fact that the students make continual application of the principles of precision in the laboratory where difficulties may be cleared up by conferences with instructors, yet the necessity for a change in the method of instruction from one admittedly satisfactory to one less efficient because of inadequate room facilities, indicates clearly the congested condition of the Department and of the Institute.

There has been a considerable increase in the amount of instruction in heat measurements called for in several courses and, furthermore, graduate instruction is now being given to several students. Among the particular problems which have been the subject of original research during the past year are the economical thickness of insulating coverings for heated surfaces; a study of the thermal properties of Portland cement concrete; and the investigation of the condensation of moisture through concrete walls.

There has been added to the laboratory equipment considerable original apparatus for the measurement of thermal conductivities and for instruction in the methods of determining these.

The call made upon this laboratory during the second term for heat measuring apparatus employed in thesis work of students belonging to other departments but working upon theses in charge of this Department increases year by year, and is attaining such magnitude that some provision will soon be necessary to meet this special need. Especially

is this true of standard thermometers and pyrometers and apparatus for the determination of heats of combustion.

As stated in the Department Report of last year, the Electro-chemical option of Course VIII., was made an independent Course—Course XIV.—in 1909. The immediate result of this announcement has been an unexpectedly large increase in the number of students who have elected the Course, the present registration of students in the second year being fifteen, or three times the number in the present fourth-year class. While some increase was anticipated, so large an enrollment was not looked for, or, with our present room and facilities, desired. The fourth-year laboratory, in which the professional work of the Course is carried out, has desks with equipment for but twelve students and it is difficult to see where more can be provided for. The seriousness of finding room two years hence for the men now registered in the Course cannot be overestimated; for, although some of these students will undoubtedly drop out before reaching their Senior year, the number is likely to be more than made up by college men entering the Junior or Senior class and by students who desire to elect Electro-chemistry as a part of their work for the Master's or Doctor's degree. Nearly one half of the present fourth-year class is made up of advanced students of this character, and it will be most unfortunate if such highly desirable men have to be refused admission to the laboratory because of lack of room. So far as can be foreseen, our facilities are adequate for the class next year, but for the class of 1912–13, provision will have to be made both for additional room and equipment if the present instruction is to be given.

The Laboratory of Applied Electro-chemistry has also become very much congested, and with much larger classes, it will be difficult or impossible to provide the necessary space for the kind of thesis work these men very properly desire to undertake. This year a portion of the work

hitherto performed in the Laboratory of Electro-chemical Measurements has had to be transferred to the Laboratory of Applied Electro-chemistry in order to provide space for the new 70 kilowatt transformer which has been installed for electric furnace operations and the special combination switch board, designed by Professor Derr, which is now under construction.

Since the removal last year of the motor driven alternator which furnished alternating current for the lecture room and the Electro-chemical Laboratory, the Department has received all its power from the Lowell Building. It was soon found that the capacity of the step-up transformers for transmitting the power generated by the McEwen engine was entirely inadequate. This has been remedied by the purchase of an additional 75 kilowatt transformer for which purpose a special appropriation was made by the Executive Commttee. With the growth of the work in the Laboratory of Heat Measurements and Electro-chemistry, practically the full capacity of the 150 kilowatt generator, installed for furnishing power to the Physics Department, is now needed to provide the amount required for thesis work and purposes of instruction.

CHARLES R. CROSS.

DEPARTMENT OF GEOLOGY.

The Department of Geology has been fortunate during the past year in securing an endowment for research in geophysics. This gift was provided by trustees to serve as a memorial of Edward and Caroline Rogers Whitney of Boston, to be known as the Whitney Fund. The purpose of the fund is to provide research or teaching in geophysics including investigations in seismology conducted with a view to the protection of human life and property. The donors express a preference that some investigations in geophysics be undertaken in Hawaii.

In addition to the Whitney Fund, the Department has received gifts from five subscribers for geophysical work, and another gift from two others, including a very liberal contribution from Mrs. William B. Rogers, which has made it possible to continue the lectures in economic geology by Mr. Waldemar Lindgren of the United States Geological Survey. I take this opportunity to express the gratitude of the Department to these several donors.

The geophysical funds have made it possible to continue to assist the work of Mr. F. A. Perret, in Naples. Partly through his influence an endowment of 100,000 francs has been offered by one individual to start an International Volcanological Institute in Italy, and the same subscriber promises 10,000 francs per annum for ten years. Mr. Perret's work is supported largely by the Volcanic Research Society of Springfield. This society has recently been enlarged and, in association with the Science Museum of that city, will maintain exhibits illustrative of volcanic and seismic phenomena.

The Whitney gift now makes possible a definite program of investigations in the Hawaiian Islands. The Geophysical Laboratory of the Carnegie Institution of Washington promises coöperation in this work, and under the direction of Mr. Shepherd of that laboratory, an electric thermometer has been built devised for measuring the temperature of liquid lava. Dr. Shepherd plans to test this apparatus in the Hawaiian field in the summer of 1911, in coöperation with our Department. With the kind assistance of Professor F. Omori of the University of Tokyo, a horizontal pendulum tromometer (magnification = 120–200), and a seismograph for the observation of ordinary earthquakes, have been made by the Educational Appliance Company of Tokyo, and shipped to Honolulu. These instruments were tested in Professor Omori's laboratory, and are designed for use at the Whitney observatory in Hawaii. The United States Weather Bureau has prepared a set of meteorological instruments for this Hawaiian station.

In May, Professor Jaggar, accompanied by Professor Spofford of the Department of Civil Engineering, went to Costa Rica by invitation of the United Fruit Company, and during seven weeks of travel, a comprehensive study was made of earthquake belts and earthquake construction in Central America and the West Indies. The special occasion for this journey was the destruction of the city of Cartago by earthquake on May 4. A preliminary report on the results of this expedition has been made to the Boston Society of Civil Engineers.

During the winter Professor Daly was chiefly occupied with the completion of his final report on the geology of the North American Cordillera at the Forty-ninth Parallel of Latitude. The manuscript was sent to the Canadian commissioner of Boundary Surveys on April 15th; the report will appear in two volumes, accompanied by an atlas. Other subjects of his investigations are noted in the list of publications.

Mr. Norman L. Bowen, candidate for the Doctor's degree, has published an excellent paper on Diabase and Granophyre of the Gowganda Lake District, Ontario.

Arrangements have been made with the director of the Geological Survey of Canada whereby Messrs. Allan and Schofield, candidates for the Doctor's degree, are now preparing materials for their graduation theses in areas selected in the Canadian Rocky Mountain and Purcell Mountain ranges. Both of these candidates have published summary reports of their government work done during 1909. Mr. Bowen was chief of a party sent by the Ontario Bureau of Mines to the Lake Superior region. The Geophysical Laboratory of the Carnegie Institution at Washington has generously offered a research fellowship to a student recommended by this Department. Mr. Bowen was appointed for this year, and is engaged on an investigation in geophysics, which will furnish matter for a graduation thesis at the Institute.

There has been no notable additions to the mineralogical collection, nor of apparatus during the past year. To the petrographical collections several suites of rocks from Canadian and American localities have been added, as well as a considerable number of thin-sections of local rocks.

During the past year, Professor Warren has completed an exhaustive study of the crystallographic and optical characters of Calcium Carbide in connection with certain professional work. It is expected that this will be published in due course of time. During the summer he made a professional examination of the titanium deposits near Bay St. Paul, Quebec, collecting an interesting suite of specimens illustrating the occurrence of these unique ores. He has prepared, in coöperation with Professor Palache, of Cambridge, two papers which will appear during the coming winter, one entitled, "The Pegmatites of the Aegirite-Riebeckit Granite of Quincy, Mass.; their Minerals, Structure, and Origin," and the second, "The Chemical Composition of Parisite and a New Occurrence of it in the Granite of Quincy, Mass." The first of these will appear in the *Proceedings of the American Academy of Arts and Sciences*, and the second in the *American Journal of Science*. He has also published a Manual of Determinative Mineralogy, written especially for the work of the third-year course in mineralogy. This is printed by the Institute.

That portion of the Department appropriation which is allotted to mineralogy and petrography is barely sufficient to meet the running expenses of the work and provide for the depreciation of the collections and instrumental equipment. The addition of new material and instruments is out of the question. This is greatly to be deplored, for the undergraduate work in mineralogy and petrography is greatly in need of additional material and apparatus, while for graduate work, type collections of specimens and thin-sections from several localities are needed, chiefly foreign places which have become classic,

and which would be of the greatest value for purposes of comparison and study. Our equipment is, in fact, so deficient in this respect that our advanced instruction in petrography suffers very seriously.

Mr. Waldemar Lindgren, M.E., Geologist in charge of the sections of Mining Geology and Metal Statistics of the United States Geological Survey, has been reappointed Lecturer in Economic Geology for 1910–1911. Mr. Lindgren began his work November 16, on leave of absence from Washington for five weeks. During this time, while residing in Boston he gave a course of thirty-five lectures and conferences on Economic Geology with particular reference to the ore deposits of the Western States. During the summer Mr. Lindgren attended the meeting of the International Geological Congress in Stockholm and visited some important ore deposits in Sweden and Germany.

Professor Hervey W. Shimer spent the first three months of the summer vacation studying the Devono-Carboniferous rocks in the eastern Canadian Rockies, near Banff, Alberta, for the Canadian Geological Survey. During September, rocks were examined and collections made for the Institute in British Columbia, California, and Texas. Recent acquisitions for laboratory work include charts and zoölogical mounted material for comparison with fossil forms and a series of ninety thin-sections of fossil bryozoa. The collection of fossils for comparative study was enriched through exchange, by sets of fossils from Montana, Dakota, Washington, and California. There is a strong need for a series of charts and lantern slides, particularly for stratigraphic work and for more cases for the storage of laboratory material.

Professor Crosby continued his work as consulting geologist for various companies, and he is now engaged in the study of asphalt deposits in Alabama.

Dr. Loughlin continued his studies of the geology of southeastern New England, and has published contribu-

tions to the geology of Connecticut and Rhode Island. During August and September he was employed by the United States Geological Survey in northern Idaho, making field geological surveys for purposes of government land classification. He has also been employed in private expert work, chiefly in relation to building stones and road materials. He has discontinued his teaching at Boston University, and this year teaches Economic Geology at the Institute in association with Mr. Lindgren, and is in charge of the Petrologic Laboratory.

Dr. Charles H. Clapp completed with high credit all requirements for the degree of Doctor of Philosophy in geology, in June, 1910, and it is a pleasure to report the unusually thorough and careful work represented in his thesis on "The Igneous Rocks of Essex County, Mass." Notwithstanding the heavy expense involved in printing, it is hoped that this thesis can soon be published *in ex tenso*. Dr. Clapp has continued his work in charge of a party, as geologist of the Geological Survey of Canada, and is now engaged in preparing for publication the results of his surveys in Vancouver Island.

During the past summer Mr. John A. Allan began a reconnaissance and a detailed study of the geology of the Ice River District, B.C., and the district about Field, B.C., for the Geological Survey of Canada. Mr. Schofield continued his work in the St. Mary's River District, East Kootenay, B.C., also for the Canadian Survey.

T. A. JAGGAR, JR.

DEPARTMENT OF NAVAL ARCHITECTURE.

The progress in the Department of Naval Architecture and Marine Engineering during the last year has been in the line of development of changes and extensions in the curriculum that were rendered possible by certain changes in general policy by the Faculty. Those changes have only now been carried to completion and I have to report that the expected advantages have been realized. Since the changes have already been stated in detail, it may be sufficient to say that in general they have been in the main an addition to the training in such fundamental subjects as mathematics and applied mechanics, and an extension and rounding out of the practical work in ship construction. This is true both of the regular course and of the special course for naval constructors.

The following changes have taken place in the staff of the Department: Assistant Professor Walter S. Leland has handed in his resignation to take effect February 1st; Mr. Herman R. Hunt (Instructor in Naval Architecture) has resigned and Mr. Henry H. W. Keith, '05, has been appointed in his place. Mr. Gordon G. Holbrook, '10, has been appointed Assistant in place of Mr. Harold S. Wonson.

A course of five lectures on "Marine Propeller" were given in May by Mr. Sidney Bamaly, scientific expert to Sir John Thornycroft & Co., of Southampton, England. The means for these lectures were provided by Dr. Weld.

In the report of last year there was mention of a proposition by Dr. Weld that the Department should undertake experiments on propulsion of ships by aid of a navigable model. In the spring the hull was launched at the yard of Stearns & MacKay at Marblehead, and named the *Froude*. The machinery was put in at Lynn by the General Electric Company, and the outfit was completed, mainly by the mechanics of the Institute in the Charles River

Basin. During the summer experiments were carried on under the direction of the head of the Department by Messrs. Everett and Chapman, consisting essentially of progressive speed trials over a measured course, determining the power and thrust of the propeller under various conditions. In connection with this work a smaller model, twenty-three and one-half feet long, was made in our model shop and tested by Naval Constructor D. W. Taylor, U.S.N., who also tested the propeller of the *Froude*. In consideration of the fact that the experiments were for scientific and educational purposes, no charge was made by the Navy Department for these tests in the model basin at Washington.

A special model fifty feet long with three feet draught and one foot beam was built at Garrison Street and towed in Charles River Basin to investigate fluid friction.

The *Froude* is a model, to one-fifth size, of the Revenue Cutter *Manning* which was tested by the Department in 1899; in June a series of progressive speed trials were made at Provincetown on the sister ship *Gresham*, by permission of Captain Worth G. Ross, R.C.S., Captain-Commandant.

The propeller for the *Froude* was planed to correct form by the Fore River Shipbuilding Company, and they have made three other propellers of varying proportions which will be used next summer.

The students of the Department, both those in the regular course and those in the course for naval constructors, have had laboratory work on the *Froude* and the data taken by them will serve as the basis of problems on progressive speed trials.

A paper was presented to The Society of Naval Architects and Marine Engineers by Professor Hovgaard entitled "An Analysis of Tests on Water-tight Bulkheads, with Practical Rules and Tables for Their Construction."

C. H. PEABODY.

DEPARTMENT OF MATHEMATICS.

There have been no very notable changes in the work of the Department during the year.

Professor Osborne has become professor emeritus, but is at his own desire still continuing a small amount of teaching with second-year students. Professor Osborne came to the Institute in 1866, and has long been the senior member of its Faculty. He was Secretary of the Faculty from 1868 to 1871, and has held the Walker professorship since 1903. In 1906 he was absent during most of the year on account of ill health, and since that time he has taken only half work, though with no loss of his exceptional clearness and skill in presentation and little evident impairment of physical vigor, even after forty-four years of almost unbroken service.

Professor Woods has returned this fall after a profitable year's leave of absence, spent mainly in Paris.

Dr. Lennes, who had been reappointed to an instructorship in consequence of Professor Woods' temporary absence, has now become instructor at Columbia University, while Mr. B. E. Carter, who had been instructor since 1893 has accepted an instructorship at Colby College and is succeeded by Dr. Frank L. Hitchcock. Dr. Hitchcock received his Bachelor's degree at Harvard in 1896, where he has recently taken his Doctor's degree, after holding school and college appointments in chemistry and physics.

A study of the records of students admitted from other colleges shows that at present about one third of our students have taken their trigonometry at other institutions, about one fourth, the first-year mathematics, and about one sixth, that of the second year. It is still necessary to make special provision for a small group entering our second year with no previous knowledge of the calculus.

A preliminary study has also been made during the year of the amount and distribution of time in preparatory school work in algebra and geometry. The results indicate a remarkably wide range of variation for subjects so long established in the high school curriculum. On the other hand it has not been possible to take into account the important effect of size of classes. A small time allotment may be easily offset by the greater efficiency attainable in teaching small classes.

The Department was represented at a conference of New England colleges held in May at Cambridge for the consideration of definitions of entrance requirements in mathematics. The conference resulted in general agreement in favor of the use of the definitions of the American Mathematical Society Committee of 1903, which have long since been adopted by the Institute.

The head of the Department has during the year acted as chairman of the Committee on the Teaching of Mathematics in Technological Schools and Departments of Collegiate Grade, for the International Commission on the Teaching of Mathematics.

There is a gradual and welcome development of interest in advanced mathematical courses at the Institute. A class of nearly twenty older students and junior members of the Instructing Staff is now meeting twice a week for advanced calculus. Last year a course on the elements of the theory of functions of a complex variable was given for the first time.

H. W. TYLER.

DEPARTMENT OF DRAWING AND DESCRIPTIVE GEOMETRY.

The changes in the arrangement of rooms and in the methods of instruction made last year have proved very satisfactory both in regard to economy of time and the quality of the results. The number of students who satisfactorily passed the requirements was approximately ten per cent. greater than under the old system.

There have been no changes in the Instructing Staff. A considerable number of new problem plates on Descriptive Geometry have been issued during the year, and Professor Adams has completed the portion of his Descriptive Geometry on Warped Surfaces. The book was ready for use in the summer school.

The special four o'clock class in Descriptive Geometry for students entering from other colleges has been well attended. The number of students taking this course was fifty-nine.

While the equipment of the drawing rooms is fairly satisfactory, attention is called to the fact that portions of the rooms are so dark that it is necessary for some of the students to draw by electric light. The strain on the eyes, as well as a decreased accuracy in the drawing urgently call for properly lighted rooms. Many of the drawing tables are of an obsolete type and should be replaced by satisfactory ones.

The student work on the Huntington Hall frieze, in charge of Mr. W. Felton Brown, was continued, and a new panel was added. This panel, typifying Commerce, is an exceptionally good one; perhaps the best in the frieze. It is the work of Mr. K. E. Carpenter, Course IV., and represents the activity of freight handlers working on the wharves with shipping seen in the distance. The original sketch for the drawing was supplemented by a miniature reproduction in clay modelled by Mr. Carpenter.

ALFRED E. BURTON.

DEPARTMENT OF MECHANIC ARTS.

The total number of students now receiving instruction in the Mechanical Laboratories is two hundred and eighty. Some attend in more than one class, the numbers attending in the several subjects being as follows:—

Subject.	*Course.*	*Students.*
Carpentry and Wood Turning . . .	II.	62
Forging	II. and XIII.	74
Metal Turning	VI., X. and XIV.	94
Foundry Work	II. and XIII.	67
Machine Tool Work	II. and XIII.	51
Total in all classes.		348
Students attending work in two or more classes and counted more than once		68
Total number of students		280

The total number of students attending last year was two hundred and eighty-three. The number of excuses in Joinery, Wood Turning and Forging granted to students entering from the Mechanic Arts High Schools is still increasing and our course in Wood Work is now arranged to include as much Pattern Work as possible.

Summer School.—The attendance in the Summer School was thirty-five, thirteen less than last year. The numbers attending the several classes were:

Wood Work	3
Forging	4
Chipping and Filing	4
Metal Turning	3
Machine-Tool Work	21
Total.	35

There has been a falling off in attendance in nearly all subjects. The attendance in Machine-Tool Work continues largest, due to the desire of many students to anticipate the

Mechanic Arts of the Senior year. This allows more time to be devoted to thesis, or to allied work in other departments, and is a good reason for continuing the summer session.

Lecture Room.—As formerly stated a lecture room fitted with a lantern is needed for illustrated lectures descriptive of processes and methods which cannot be carried out with our equipment. Such a lecture room can be fitted up in a part of the old Union Room and will enable much more work in this line to be done than at present, when all arrangements are contingent on the availability of rooms in the Engineering Buildings. It is hoped that funds to fit up such a room will soon be available.

Equipment.—The various changes and additions in the several laboratories are given below, also suggestions for future additions.

Machine Tool and Filing Laboratories.—A complete set of electric pyrometers has been attached to the hardening furnaces, making exact temperature control possible. This will enable much more efficient work to be done and will permit investigations of hardening processes. The 9-foot x 9-inch belt-driven air compressor loaned by the Chicago Pneumatic Tool Company has been purchased at a very reasonable price. Three old engine lathes have been replaced by new machines supplied by the F. E. Reed Company at a very low price. Three remaining old lathes, purchased in 1876, should be replaced as soon as possible. New small tools have been added to the equipment of the Filing Laboratory. A small automatic screw-machine, permitting instruction in the operation of automatic machinery a small radial drill, and an additional milling machine are very much needed.

Wood Working Laboratory.—A bench and some new small tools have been added; the former donated by E. H. Sheldon & Co.

Some of the lathes, in use since 1877, should be renewed,

a few of these being replaced by larger machines. A surface planer is also very much needed.

Forging Laboratory.—The equipment is nearly worn out and only necessary repairs were made. Four new anvils have replaced old ones. Unless the laboratories are soon to be moved some new forges should be purchased.

Foundry.—The archway connecting the moulding and melting room has been enlarged and four electric lights have been added, all resulting in greater convenience and better light. The old cupola furnace has been supplied with a new stack and can thus be made to serve a few years longer. A new and larger furnace is needed but the space available in the present melting room is too contracted for a proper installation.

Four moulding machines have been added to the equipment. A 10-inch power rammer and an 18-inch rollover machine, both fully equipped with vibrators and all other appliances, were supplied by the Tabor Manufacturing Company at a very reasonable price. Two machines illustrating the use of "stripping plates," completely equipped with patterns and plates, were donated by the Saco-Pettee Company of Newton Upper Falls. These machines will enable the students to obtain experience in the use of typical moulding machinery, and will serve as a good introduction to the illustrated lecture work in the same field. A new gas furnace for melting white metal has been installed and several pneumatic tools will be added later.

Many new patterns and exercises have been added and the space is becoming very crowded. An extension of the laboratories to cover a part of the ground between the present building and the Gymnasium would supply a good melting room and an addition to the foundry and enable a larger cupola furnace to be installed.

Building.—The building has been thoroughly painted outside and is in fair condition. The floors in the Machine-Tool and Wood-Turning Laboratories are too unsteady for

machines and new floors would render better work possible. The electric lighting plant is working very well and the improvement is very much appreciated. A turbine blower, presented by the L. J. Wing Manufacturing Company, has been installed in the boiler room with a view of utilizing a cheaper fuel with a resulting reduction of smoke and increased economy.

Instructing Staff.—The Instructing Staff remains the same as last year. Mr. Jeremiah F. O'Neill spent a large part of his vacation in visiting foundries and in fitting up our foundry. As a result the work has been very much improved and extended. Mr. Robert H. Smith, has just published two text-books of a series of three on Machine Work, the "Elements of Machine Work" and "Principles of Machine Work." The third, "Advanced Machine Work" is now in preparation. These text-books are now being used in the classes in Chipping and Filing, Metal Turning, and Machine-Tool Work, to supplement the regular oral instruction. Their use will result in more and better work being done.

PETER SCHWAMB.

DEPARTMENT OF ENGLISH.

The work of the year in the English Department has been conducted in the usual manner. The conference system is carried on with much care and faithfulness and the coöperative work with other departments gives excellent results. The pamphlet used as an introduction to First-Year English has been completely revised or rewritten, and seems now especially well adapted to the use made of it. The Special Section work, a form of instruction which was devised and first introduced at the Institute, although it has since been used elsewhere, deserves mention. Many students at the close of the Freshman year show creditable proficiency in English composition, but from carelessness

or from lack of proper preliminary training fall away rapidly after gaining credit for the course. The vacation between Freshman and Sophomore or that between Sophomore and Junior years often seems to be hopelessly destructive of whatever ability of accurate expression they have gained. These men, whenever they can be discovered, are given special personal work in composition to pull them up again. It is impossible to hope that all of them keep up, but undoubtedly some do; and in many cases the moral effect of such a special condition is greater than all the regular training.

Associate Professor Pearson has been granted leave of absence for the year, and the Department has borrowed from the University of Illinois Arthur J. Tietje, Instructor.

ARLO BATES.

DEPARTMENT OF HISTORY AND POLITICAL SCIENCE.

The new schedule of studies of the Course in Architecture, adopted two years ago, providing for the extension of the Course in the History of European Civilization and Art previously given in the fourth year over both the third and fourth years, has now come into effect. As so much use is made of illustrative material in this course the change involves a great increase in the labor of instruction. As Assistant in this work the Department is especially fortunate in having obtained the services of Mr. L. Earle Rowe, whose position on the staff of the Museum of Fine Arts will be of value in bringing our students into closer contact with the important collections and work of the Museum.

CHARLES F. A. CURRIER.

DEPARTMENT OF MODERN LANGUAGES.

During the past year a reorganization of the Department of Modern Languages has been effected and the progress made under the changed conditions, although of only two months' standing, points toward increased permanent efficiency. Briefly stated the conditions are as follows:

For admission to the Institute of Technology an examination in both German and French is required. The preparation for these examinations is expected to be acquired in four to five recitations a week during two years at the preparatory school. These admission examinations are termed Elementary German and Elementary French. After entrance, during the first year in the Institute, every student continues German, unless he intends to enter the Course in Architecture. This is Intermediate German and the reading gradually advances from a general literary to a special scientific character.

French is continued during the first year by all students who plan to enter the Course in Architecture. This is Intermediate French, in which the student is introduced to the vocabulary of Science and of the Fine Arts.

In the second year, all students in Courses V. and VIII. continue the study of German throughout the year, while those in Courses VI., X. and XIV. continue the study of German during the first half year. This is Advanced German, in which the reading aims to be special and scientific, and is adapted, as far as may be, to the individual courses.

In Courses I., II., III., IV., IX., XI., and XIII. no foreign language is required in the second year.

In the third year, optional courses of advanced grade are given in both German and French, in which opportunities for the study of special phases and periods of German and French literature are offered.

Opportunity for studying Italian and Spanish is also

offered those who wish to extend their linguistic and literary training.

Reading, writing, and speaking in the foreign language is practised, as far as this is feasible, in all the modern language sections, and special classes for practice in German and French conversation are maintained.

There are twenty-five sections in German, distributed among five instructors, averaging a little over nineteen students in each section; and seven sections in French, Italian and Spanish, assigned to two instructors, averaging about fourteen students in each section.

Among the students who have entered the Institute from other colleges this fall, one hundred and twenty-three were able to satisfy completely or partially the German requirement for the course at the Institute which they wished to enter, and one hundred and eighteen satisfied the requirement in French in a similar way.

The personnel of the department has undergone some change inasmuch as Professor John Bigelow, Jr., resigned his position as Professor of French and Head of the Department to take effect on October 1, 1910. Professor Vogel was appointed Professor of German and Head of the Department, and a notable addition to the teaching force of the Institute was made in the appointment of Professor Ernest F. Langley as Professor of French. Professor Langley comes to us with an established reputation for scholarship and a record for successful teaching from Dartmouth College.

FRANK VOGEL.

The Society of Arts.

During the season of the Society of Arts just closed, forty-two members have been admitted to the Society, and the attendance and interest have been very satisfactory. The lectures given before the Society of Arts during the season of 1909–10 have been as follows:

663d meeting, December 6, 1909. "The Sanitary Disposal of City Wastes." By Professor William T. Sedgwick.

664th meeting, December 16, 1909. "The Moon as a Living Planet." By Professor William H. Pickering.

665th meeting, January 12, 1910. "Japanese Volcanoes." By Professor Thomas A. Jaggar, Jr.

666th meeting, January 26, 1910. "The Experimental Evidence for Modern Views as to the Nature of Electricity." By Professor Charles R. Cross.

667th meeting, February 9, 1910. "The Services of Chemistry in the Promotion of Public Welfare. By Dr. Harvey W. Wiley.

668th meeting, February 23, 1910. "The Chemistry of Modern Illuminants." By Professor Henry P. Talbot.

669th meeting, March 11, 1910. "Comets." By Professor Percival Lowell.

670th meeting, March 30, 1910. "The Gyroscope and its Practical Application in Steadying Ships, Monorail Locomotion, Aerial Flight, and as a Mariner's Compass." By Mr. E. A. Sperry.

The *Bulletin* of the Society of Arts which has been published for two years since the discontinuance of the *Technology Quarterly* has made many friends, but as there seems to be a desire for a publication of a somewhat larger scope, it has been found desirable to enlarge it and change its name to *Science Conspectus*. It will contain a brief general survey of the field of science and its applications, and the aim will be to make every article of some educational value to every reader, thus following out in some degree, the original aim of the Society of Arts, which was formed fifty years ago for the purpose of the dissemination of scientific knowledge by means of public lectures and discussions.

The receipts and expenses of the Society of Arts for the past year are as follows:

Receipts		
Dues	$936.12	
Unexpended balance of 1908 appropriation	375.00	
		$1,311.12
Expenses		
Printing Bulletins and miscellaneous	$535.44	
Secretary	200.00	
Lectures and entertainment of speakers	69.62	
Postage and mailing Bulletins	44.90	
Clerical work	57.65	
Stationery and Bulletin Envelopes	71.93	
		$979.54
On hand		$331.58

The Executive Committee elected for the coming season consists of Richard C. Maclaurin, President of the Institute, Elihu Thomson, Theodore N. Vail, James P. Munroe, Carroll W. Doten, Frederic H. Fay, and I. W. Litchfield.

The Board of Publication having in charge the publication of *Science Conspectus* consists of Daniel F. Comstock, of the Physics Department of the Institute; Selskar M. Gunn, of the Biological Department; Ellwood B. Spear, of the Chemical Department, and Lewis E. Moore, of the Civil Engineering Department.

I. W. LITCHFIELD,
Secretary.

Publications.

THE INSTITUTE.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—President's Report. *Bulletin of the Massachusetts Institute of Technology*, Vol. XLV., No. 2. Boston, January, 1910.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Summer Courses. *Bulletin of the Massachusetts Institute of Technology*, Vol. XLV., No. 2, extra number. Boston, March, 1910.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Register of Graduates. *Bulletin of the Massachusetts Institute of Technology*, Vol. XLV., No. 3. Boston, March, 1910.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Programme. *Bulletin of the Massachusetts Institute of Technology*, Vol. XLV., No. 4. Boston, June, 1910.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Officers of Instruction, 1910–11. Boston, November, 1910.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Catalogue. *Bulletin of the Massachusetts Institute of Technology*, Vol. XLVI., No. 1. Boston, December, 1910.

ADMINISTRATIVE OFFICERS.

RICHARD C. MACLAURIN.—Science and Education. *The School Review*, Vol. XVIII., p. 319.

RICHARD C. MACLAURIN.—Some Tests of Academic Efficiency. *Popular Science Monthly*, Vol. LXXVII., p. 487.

RICHARD C. MACLAURIN.—Technical Education. *Youth's Companion*, June, 1910.

CIVIL AND SANITARY ENGINEERING.

C. FRANK ALLEN.—Paper on Definition of Degree of Curve. *Proceedings of American Railway Engineering and Maintenance of Way Association*, 1909.

C. FRANK ALLEN.—(as member and Vice-Chairman) Report of Committee on Economics of Railway Location. *Proceedings of American Railway Engineering and Maintenance of Way Association*, 1910.

HAROLD K. BARROWS.—Surface Water Supply of the United States, 1907–8. Part I, Atlantic Coast. *Water Supply Paper 241*, United States Geological Survey.

HAROLD K. BARROWS (with R. H. BOLSTER).—St. Lawrence River Basin 1907–8, Part IV. *Water Supply Paper 244*, United States Geological Survey,

GEORGE L. HOSMER.—Text Book on Practical Astronomy. New York. John Wiley & Sons. 1910.

LEWIS E. MOORE.—Review of Andrews "Theory and Design of Structures." *Engineering News*, Vol. LXIII., No. 15, April, 1910.

MECHANICAL ENGINEERING.

EDWARD F. MILLER.—Effect of Superheated Steam on the Strength of Cast Iron and Steel. *Proceedings of American Society Mechanical Engineers.* December, 1909.

CHARLES W. BERRY.—The Temperature Entropy Diagram. Revised Edition. John Wiley & Sons. 1910.

MINING ENGINEERING AND METALLURGY.

ROBERT H. RICHARDS.—Development of Hindered Settling Apparatus. *Transactions American Institute of Mining Engineers*, 1910; *Journal of the Canadian Mining Institute*, 1910; *Western Chemist and Metallurgist*, 1910.

ROBERT H. RICHARDS and CHARLES E. LOCKE.—Progress in Gold Milling in 1909. *The Mineral Industry*, Vol. XVIII., 1909.

ROBERT H. RICHARDS and CHARLES E. LOCKE.—Progress in Ore Dressing and Coal Washing in 1909. *The Mineral Industry*, Vol. XVIII., 1909.

HEINRICH O. HOFMAN.—Recent Improvements in Blast Roasting. *Transactions American Institute of Mining Engineers*, 1910.

HEINRICH O. HOFMAN.—A Biographical Notice of Franklin R. Carpenter. *Transactions American Institute of Mining Engineers*, 1910.

HEINRICH O. HOFMAN.—Recent Improvements in Lead Smelting. *The Mineral Industry*, Vol. XVIII., 1909.

HEINRICH O. HOFMAN and CARLE R. HAYWARD.—Pan Amalgamation, an instructive laboratory experiment. *Transactions American Institute of Mining Engineers*, Vol. XL., 1909, p. 382.

HEINRICH O. HOFMAN and CARLE R. HAYWARD.—Supplement to Pan Amalgamation, an instructive laboratory experiment. *Transactions American Institute of Mining Engineers*, Vol. XL., 1909, p. 868.

HEINRICH O. HOFMAN and W. MOSTOWITSCH.—The Reduction of Calcium Sulphate by Carbon Monoxide and Carbon, and the Oxidation of Calcium Sulphide. *Transactions American Institute of Mining Engineers*, 1910.

CHARLES E. LOCKE.—See Robert H. Richards.

CARLE R. HAYWARD.—See Heinrich O. Hofman.

CHEMISTRY AND CHEMICAL ENGINEERING.

HENRY P. TALBOT.—The Outlook for a Better Correlation of Secondary School and College Instruction in Chemistry. *Science*, Vol. XXXI., pp. 961–974.

HENRY P. TALBOT.—New England's Share in the Training of Chemists. *Advance New England*, Vol. I., p. 351.

WILLIAM H. WALKER.—Achievements of Some New England Chemists. *Advance New England*, Vol. I., p. 346.

AUGUSTUS H. GILL and E. H. BARTLETT.—On the Determination of Carbonic Oxide in Illuminating Gas by Iodine Pentoxide. *Journal of Engineering and Industrial Chemistry*, Vol. II., p. 9.

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SAMUEL P. MULLIKEN.—Identification of the Commercial Dyestuffs. Vol. III of *A Method for the Identification of Pure Organic Compounds*. New York. John Wiley & Sons. 1910.

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ARTHUR A. BLANCHARD.—Synthetic Inorganic Chemistry. 2d Edition. New York. John Wiley & Sons.

ELLWOOD B. SPEAR.—Electrolytic Determination of Zinc. *Journal of the American Chemical Society*, Vol. XXXII., p. 530.

ELLWOOD B. SPEAR.—On the Causes of the High Results in the Electrolytic Determination of Zinc. *Journal of the American Chemical Society*, Vol. XXXII., p. 533.

ELLEN H. RICHARDS.—Conservation by Sanitation, Air, and Water Supply, Disposal of Wastes, including a Laboratory Guide for Sanitary Engineers. New York. John Wiley & Sons.

ELLEN H. RICHARDS.—Euthenics, the science of controllable environment. A plea for better living conditions as a first step toward higher human efficiency. Boston. Whitcomb & Barrows.

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ELLEN H. RICHARDS and ROYCE W. GILBERT.—Stagnation versus Circulation in House Air. Preliminary Notes. Read at the American Chemical Society, Boston, December 27–31, 1910. *Proceedings American Chemical Society.*

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RESEARCH LABORATORY OF PHYSICAL CHEMISTRY.

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No. 46.—The Hydrolysis of Ammonium Acetate and the Ionization of Water at High Temperatures. By A. A. Noyes, Yogoro Kato, and R. B. Sosman. *Journal of the American Chemical Society*, Vol. XXXII., pp. 159–178; *Zeitschrift für physikalische Chemie*, Vol. LXXIII., pp. 1–24.

No. 47.—The Potential of the Thallium Electrode. By Gilbert N. Lewis and Carl L. von Ende. *Journal of the American Chemical Society*, Vol. XXXII., pp. 732–740.

No. 48.—The Ionization of Salts in Mixtures with no Common Ion. By Miles S. Sherrill. *Journal of the American Chemical Society*, Vol. XXXII., pp. 741–748.

No. 49.—The Theory of the Determination of Transference Numbers by the Method of Moving Boundaries. By Gilbert N. Lewis. *Journal of the American Chemical Society*, Vol. XXXII., pp. 862–869.

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TREASURER'S REPORT

FOR THE YEAR ENDED SEPT. 30, 1910.

Treasurer's Report.

To the Corporation of the
Massachusetts Institute of Technology:

I have the honor to submit herewith statements showing the financial condition of the Massachusetts Institute of Technology as of September 30, 1910, as well as the financial transactions during the fiscal year ended on that date.

These statements are presented in accordance with standard forms devised by the Carnegie Foundation for the Advancement of Teaching, for the purpose of making uniform, so far as practicable, the annual financial reports of universities, colleges and technological schools throughout the country. Particular attention is called to the balance sheet, Schedule D, in which a complete statement of the assets and liabilities of the Institute is exhibited.

The following gifts and legacies have been received during the year, and call for the sincere thanks of the Institute:

GIFTS, BEQUESTS, ETC., 1909–10.

Available for Current Expenses.	
General.	
M. I. T. Alumni Fund	$40,644.15
Estate of Thomas Gaffield	1,000.00
Special.	
Charles G. Weld for Naval Architecture Department	8,000.00
"A friend of the Institute," for Sanitary Research Work	5,500.00
Dr. A. A. Noyes, for the Physico-Chemical Research Department	4,200.00
M. I. T. Alumni Association, for printing "Register of Former Students"	1,000.00
M. I. T. Alumni Association, for "President's Fund"	1,000.00
Charles W. Hubbard, for Research Work in Applied Chemistry (this is the third of the three annual payments)	1,000.00
Prof. F. J. Moore, for Salaries, account of 1910–11	1,000.00
Arthur A. Cary	500.00
Saturday Club, for the purposes of the General Library	500.00
Harvey S. Chase & Co., toward "Installation of Uniform Accounting Methods"	250.00
Major John Bigelow, Jr., for Modern Language Notes	17.05
Paint Manufacturers' Co., for Research Work in Applied Chemistry	150.00

For New Funds or Increases of Funds.

Gifts for Improvement Fund:	$7,000.00
Gifts for Seismological Research Fund:	
Mrs. W. Scott Fitz	$1,250.00
E. D. Barbour	400.00
Arthur F. Estabrook	300.00
Godfrey L. Cabot	100.00
George G. Crocker	100.00
F. G. Webster	100.00
Hornblower & Weeks	100.00
Frank E. Peabody	100.00
	$2,450.00
Estate of Edward Whitney, for "Whitney Fund"	$20,000.00
Estate of Caroline Whitney, for "Whitney Fund"	5,000.00
Estate of Charles Choate	7,149.54
Estate of Susan E. Dorr	1,000.00
Thomas A. Edison, for "Newsboys' Scholarship Fund"	100.00
L. J. Wing Manufacturing Co., New York, one Typhoon Turbine Blower	200.00

The following facts in relation to the "Alumni Fund" may be interesting:—

During the year 1906 there was received from the Alumni Fund Committee $42,583.61
This was placed in the general fund and used for current expenses.

In the year 1907 there was received $46,588.04
A part of this gift was expended in buying special apparatus for the Mechanical Engineering Department and for the Electrical Engineering Department and in salary payments to strengthen the Instructing Staff.

In addition $10,000.00 was reserved to be applied during the year 1908 for certain special purposes, such as "the purchase of a steam turbine and the extension of the plan of personal conference between first year students and instructors."

During the year 1908 there was received....$35,701.41
from the Alumni Fund Committee, which was expended, together with a part of the money reserved from the previous year, as follows:—

For one-half the cost of erecting and equipping the new Technology Union	$8,500.00
For installing new boilers and improving the heating and power plant	9,750.00
Carried forward	$18,250.00

Brought forward	$18,250.00
For fittings and installation of the new steam turbine	2,690.00
For steel testing machine for Mechanical Laboratory	500.00
For equipment of the extension of the Laboratory of Analytical Chemistry	650.00
For maintenance and improvement of Athletic Field	1,600.00
For providing for personal conferences between first-year students and instructors	1,600.00
For increase of salaries of the Instructing Staff	16,600.00
Total	$41,890.00

During the year ended 1909 there was received from the Alumni Fund Committee $41,147.94

This money was expended as follows:—

Additions to Technology Union (in excess of direct gifts)	7,786.94
Salary increases	10,269.00
Electric light in Mechanical Laboratories	2,200.00
Changes in Gymnasium	1,300.00
Additional Mining Machinery	325.00
	$21,880.94
Other outlays and special repairs	19,267.00
	$41,147.94

During the year 1909–10 there was received on account of the Alumni Fund $40,644.15

This money has been expended as follows:—

For cost and erection of the generator for Parsons' Turbine, installed in 1908		$3,490.00
For a Curtis Turbo-Generator set		2,500 00
For new shaft for No. 3 Westinghouse Engine		475.00
For new pistons and rods for condenser pump in the Power House		250 00
For new shaft in MacIntosh-Seymour Compound engine		400.00
For two rotary converters with transformers and rheostat for supplying high voltage current		1,825.00
For new steel lockers in Gymnasium		945.00
For a new blue-print machine and room for the Mechanical Engineering Department		600.00
For changes in various rooms:—		
Free-hand Drawing Room	$700.00	
Mrs. Richard's Room, Walker	500.00	
New Tech Office	90.00	
Engineering Library	300.00	
Room 11, Geological Department; Physics Department, etc., aggregating	$1,010.00	2,600.00
There has also been expended for increase of salaries		23,000.00
For other outlays and special repairs		4,559.15
Total		$40,644.15

Total of subscriptions received from the Alumni Fund during five years $206,665.15

The Walker Memorial Fund now amounts, with accrued interest, to $125,501.97.

It would be difficult to emphasize too strongly the financial needs of the Institute at the present time. The termination of the Alumni Fund, amounting approximately to $40,000 per year, the expiration in 1911 of the State grant of $25,000 per year, together with an annual deficit averaging at least $25,000, show the great necessity of obtaining a large addition to our income, in order to maintain our present high standards of efficient work.

Respectfully submitted,

WILLIAM B. THURBER,
Treasurer.

DECEMBER 6, 1910.

Schedule A.

FINANCIAL RESULTS OF THE YEAR.

Losses and Gains.

LOSSES.

Total Outgo, per Schedule C–1		$589,915.54
Total Income, per Schedule B–1		579,197.97
Excess of Outgo over Income		$10,717.57
Income carried to credit of funds		10,421.44
Gifts carried to credit of funds		4,210.96
Appropriated for President's Fund		500.00
Research Laboratory Organic Chemistry		300.00
Letter Box Fund, credited by receipts (net)		18.50
Total excess of expenditures and reserves		$26,168.47
Losses of other years charged off this year:		
Students' notes receivable, no value		570.50
Jacques Fund, balance re-established		1,359.45
		$28,098.42

GAINS.

Alumni Fund balance of 1909 transferred	$3,811.41	
Gain on exchange of securities	651.69	
Deposits for breakage, uncalled for	36.45	4,499.55
Net reduction of Surplus for the year (Schedule S)		$23,598.87

Schedule B–1.

INCOME.

INCOME FROM STUDENTS.	*Items.*	*Totals.*
Tuition fees	$335,823.45	
Entrance examination fees forfeited	2,090.00	
Sale of lecture notes, etc	1,736.90	
Locker fees	1,415.75	
Supplies, chemicals, laboratory materials, etc.	13,482.72	$354,548.82
INCOME FROM INVESTMENTS OF:—		
Endowments for general purposes, Schedule P	$36,225.93	
Endowments for designated purposes, Schedule Q	51,251.30	
Income not credited to funds	3,927.82	
	$91,405.05	
Less:		
Accrued interest on purchases $1,278.75		
Annuity to Samuel Dorr . 1,000.00	2,278.75	89,126.30
RENTS FROM INVESTMENTS OF REAL ESTATE (net)		6,787.53
GRANTS BY NATION AND STATE.		
Annual grant from State of Massachusetts	$25,000.00	
State of Massachusetts for scholarships	4,000.00	
Federal Aid, Income from Land Grant Act of July 2, 1862	5,306.68	
Federal Aid, Additional Endowment Acts of Aug. 30, 1890	15,000.00	49,306.68
GIFTS FOR CURRENT EXPENSES.		
For General Purposes:		
M. I. T. Alumni Fund	$40,644.15	
Estate of Thomas Gaffield	1,000.00	41,644.15
For Designated Purposes:		
Naval Architectural Fund	8,000.00	
Sanitary Research Fund	5,500.00	
Physico-Chemical Research Fund	4,200.00	
Seismological Research Fund	2,450.00	
Applied Chemistry Fund	1,150.00	
President's Fund	1,000.00	
Improvement Fund	1,000.00	
Alumni, for printing,	792.57	
Library	500.00	
Salaries	500.00	
Uniform Accounting	250.00	
Modern Languages	17.05	25,359.62
Carried forward		$566,773.10

Brought forward		$566,773.10
INCOME FROM OTHER SOURCES.		
Interest and Discount	$2,412.23	
Rents, Huntington Hall	3,500.00	
Sales of electricity	1,513.07	7,425.30
Sundry Funds Income:		
Applied Chemistry earnings	$2,496.70	
Refunds Physico-Chemical Research Fund earnings	272.10	
Sanitary Research Fund refunds	135.25	
Rogers Scholarship Fund refunds	832.50	
Letter Box rents	22.75	
Refunds Bursar's Fund	25.25	
Research Laboratory Organic Chemistry earnings	300.00	4,084.55
INCOME FROM SOCIETY OF ARTS. Dues		915.02
Total Income		$579,197.97

Schedule C–1.

OUTGO.

Description.	*Items.*	*Totals.*
SALARIES OF TEACHERS.		
Professors	$133,839.54	
Associate professors	33,350.02	
Assistant professors	56,421.37	$223,610.93
Instructors	$74,980.00	
Lecturers	7,685.00	
Librarians	1,750.00	
Assistants	38,964.47	123,379.47
WAGES ACCESSORY TO TEACHING.		
Clerks	$2,779.82	
Stenographers	5,958.97	8,738.79
DEPARTMENT SUPPLIES AND REPAIRS (per Scehdule C–2)		49,171.93
ADMINISTRATION AND GENERAL EXPENSES.		
Salaries of officers	$21,333.36	
Salaries of assistants, stenographers, etc.	14,369.09	
Advertising and printing	16,064.44	
Insurance	2,904.23	
Other General Expenses	16,334.39	71,005.51
OPERATION AND MAINTENANCE OF PLANT.		
Mechanicians' wages	$6,289.74	
Laborers' wages	44,075.09	
Light, heat, and power	25,959.31	
Repairs, per Schedule C–3.	6,031.60	
Repairs, wages	3,120.00	85,475.74
MISCELLANEOUS EXPENSES.		
Lunch-room expenses and repairs (net loss)		463.12
Premiums charged off:		
General Investments	$1,649.07	
Rogers Memorial Investments	546.00	2,195.07
Austin Fund Scholarships		4,252.88
Applied Chemistry		1,778.94
Ednah Dow Cheney Fund Library		246.89
Income of Teachers' Fund		1,647.49
Letter Box Fund		4.25
Physico-Chemical Research Fund		2,308.10
President's Fund		232.16
Sanitary Research Fund		1,756.34
Seismological Research Fund		1,679.07
Travelling Scholarship in Architecture		500.00
Weld Fund, Naval Architecture		7,741.96
Sundry Scholarships to individuals		1,550.00
Architectural Prizes		700.00
INTEREST		317.26
SOCIETY OF ARTS. Expenses		1,159.64
		$589,915.54

Schedule C–2.

Departments.	*Supplies.*	*Repairs.*
Applied Mechanics	$1,693.62	
Architecture	1,665.14	$120.64
Biology	1,343.01	185.79
Chemistry	13,231.49	1,044.21
Civil and Sanitary Engineering	1,821.73	78.22
Drawing	224.86	66.92
Economics	421.09	34.31
Electrical Engineering	2,831.81	464.75
English	121.97	15.95
General Library	2,764.66	44.34
Geology	1,162.12	256.01
History	713.15	
Mathematics	260.61	38.88
Mechanic Arts	2,328.11	241.96
Mechanical Engineering	2,241.57	631.44
Military Science	1,222.96	
Mining	2,507.95	101.74
Modern Languages	128.22	2.04
Naval Architecture	642.25	90.99
Physical Culture	1,914.29	125.91
Physics	5,818.11	569.11
	$45,058.72	$4,113.21
	4,113.21	
Total Departments	$49,171.93	

Schedule C–3.

DETAIL OF PLANT REPAIRS.

(Including Wages)

Rogers Building	$754.52
Walker Building	458.95
Lowell Building	672.20
Engineering Buildings, A and B	916.29
Engineering Building C	172.87
Pierce	245.89
Mechanical Laboratory	1,675.12
Gymnasium	1,284.44
Technology Union	45.52
Boiler Room	802.74
Power Plant	882.74
Sundries	1,240.32
	$9,151.60

Schedule D.

MASSACHUSETTS INSTITUTE
TREASURER'S BALANCE SHEET.

1.

CURRENT ASSETS.

Cash on hand and in banks, available for general purposes, Schedule E	$36,805.32
Notes Receivable, Schedule F–1	12,231.59
Accounts Receivable, Schedule F–2	373.55
Rents Receivable, less reserve, Schedule F–3	2,500.00
Physico-Chemical Research Fund (excess expenditure)	225.67
Total current assets	$52,136.13
Excess of investment assets. (Contra, below)	287,437.41
Total available assets	$339,573.54

2.

INVESTMENT ASSETS.

Securities, Schedule H		$1,995,341.50
Real Estate, Schedule I		176,917.32
Funds deposited in Savings Banks		6,623.29
Total investments		$2,178,882.11
Cash: In bank, against minor funds	8,145.68	
In bank, against funds' incomes	27,280.93	
In bank, for investment	408.04	
Total investment assets		$2,214,716.76

3.

EDUCATIONAL PLANT ASSETS.

Lands, Buildings and Equipment. Nominal Values.

Total book value at beginning of year, Schedule J	$1,694,621.33
Additions during year, Schedule K	8,415.00
Total book value at end of the year, Schedule J	$1,703,036.33

WALKER MEMORIAL. ASSETS.

Securities (page 15)	$116,173.30
Cash in bank (reserved for investment)	9,328.67
Total assets	$125,501.97

IMPROVEMENT FUND. ASSETS.

Securities, United States Steel Corporation 5s, 1963	$9,524.68
Cash in bank (for investment)	8,533.04
	$18,057.72

Schedule D.

OF TECHNOLOGY.
SEPTEMBER 30, 1910.

1.

CURRENT LIABILITIES.

Accounts Payable, Schedule N	$3,927.66
Tuition fees in advance for year 1910–11	116,717.50
Students' deposits in advance, breakage and supplies	11,712.00
Students' deposits unclaimed, breakage and supplies	1,134.82
Students' examination fees	3,020.00
Technology Union receipts in advance	88.54
Locker deposits outstanding	153.75
Gift Account, applicable for 1910–11	1,000.00
Total current liabilities	$137,754.27
Surplus of available assets over current liabilities	*201,819.27*
	$339,573.54

2.

ENDOWMENT FUNDS.

Funds for general purposes, Schedule P	$763,999.75
Funds for designated purposes, Schedule Q	1,127,627.32
Total invested funds	$1,891,627.07
Minor cash funds, Schedule R	8,371.35
Funds' income balances, Schedule R	27,280.93
Excess of investment assets, derived from unconditioned gifts and bequests invested during past years. Transferred to current assets. (Contra, above)	287,437.41
	$2,214,716.76

3.

EDUCATIONAL PLANT ENDOWMENTS AND CAPITAL ACCOUNTS.

Endowment for Electrical Engineering Building	$68,000.00
Other endowments, funds and capital (not analyzed into specific items)	1,635,036.33
	$1,703,036.33

WALKER MEMORIAL FUND.

Balance at beginning of year	$120,796.97
Net income for year, added to fund	4,705.00
	$125,501.97

IMPROVEMENT FUND.

Balance at beginning of year	$10,700.00
Net income for year and gifts, added to fund	7,357.72
	$18,057.72

Schedule E.

CASH RECEIPTS AND DISBURSEMENTS.

FOR THE YEAR.

Total Cash Receipts	$803,518.49
Total Cash Disbursements	795,897.00
Excess of Receipts	$7,621.49
Cash Balance at beginning of year	82,880.19
Cash Balance at end of year	$90,501.68

Viz.:—

CASH BALANCE.

AT END OF YEAR.

Cash on Deposit at banks:		
Old Colony Trust Company:		
For minor funds	$6,877.84	
For funds' incomes	27,280.93	
For Walker Memorial Fund	9,328.67	
For general purposes	25,021.14	
For Improvement Fund	8,533.04	
For investment	408.04	$77,449.66
National Shawmut Bank, for general purposes		12,763.54
		$90,213.20
Cash at offices:		
For general purposes		288.48
Cash Balance, as above		$90,501.68

Schedule F–1.

NOTES RECEIVABLE.

Description of Notes and Security therefor, if any	*Amount.*	*Rate of Interest.*
Chapin mortgage (property in Nahant)	$12,000.00	5%
Architectural Record	231.59	
Total	$12,231.59	

Schedule F–2.

ACCOUNTS RECEIVABLE.

For Tuition:	
4 Students	$95.00
Miscellaneous:	
Chemical Breakage	278.55
	$373.55

Schedule F–3.

RENTS RECEIVABLE.

Arrears of Rents at beginning of year		$14,500.00
Rents due during year:		
Clarendon Street (Grundmann Studios)	$5,500.00	
Huntington Hall	3,500.00	
Cabot House	1,000.00	
Massachusetts Avenue property	840.00	10,840.00
Total		$25,340.00
Collections of Rents during year		12,840.00
Arrears of Rents at end of year		$12,500.00
Less: Reserve for doubtful accounts		10,000.00
		$2,500.00

Schedule G.

INTEREST AND DIVIDENDS ACCRUED ON SECURITIES.

(Not computed.)

INVESTMENTS WALKER MEMORIAL FUND.

$30,000.00	Am. Tel. & Tel. Co. 4s	due	1929	$30,300.00	
10,000.00	Chicago, Burl. & Quincy R.R. 4s	"	1958	10,000.00	
54,000.00	N. Y. C. & H. R. R.R. 3½s	"	1998	47,986.35	
14,000.00	Oregon Short Line 5s	"	1946	16,310.00	
5,000.00	St. Louis Iron Mt. 4s	"	1933	4,812.50	
7,000.00	Wabash Equipment 4½s	"	1916	6,764.45	$116,173.30

Schedule H.

SECURITIES: BONDS, STOCKS, AND

Bonds.	*Description of Securities.*			*Balance at beginning of year.*
$26,000.00	Am. Dock & Improvement Co. 5s	due	1921	$26,880.00
105,000.00	American Tel. & Tel. Co. 4s.....	"	1929	104,700.00
25,000.00	Atchison, Top. & St. Fé R. R. 4s.....	"	1995	25,000.00
34,000.00	Baltimore & Ohio R. R. 3½s.....	"	1925	30,090.00
4,000.00	Bur. & Mo. River (Neb.) R. R. 6s non-exempt.....	"	1918	4,000.00
43,000.00	Chesapeake & Ohio R. R. 5s.....	"	1939	48,585.00
38,000.00	Chicago, Burl. & Q. R. R. 4s.....	"	1958	38,096.00
50,000.00	Chi. Junc. & Union S. Yds. 5s.....	"	1915	51,110.00
50,000.00	Chi. Junc. & Union S. Yds. 4s.....	"	1940	49,250.00
30,000.00	Chi., Mil. & St. Paul R. R. 7s.....	"	1910	30,227.00
100,000.00	Chi. & W. Michigan R. R. 5s.....	"	1921	101,100.00
17,000.00	Delaware & Hudson R. R. 4s Ref.....	"	1943	17,330.00
3,000.00	Illinois Central R. R. 4s.....	"	1951	3,000.00
120,000.00	Illinois Steel Co. non-conv. 5s.....	"	1913	119,586.25
7,000.00	K. C., Clinton & Spgfld. R. R. 5s.....	"	1925	6,289.21
50,000.00	K. C., Ft. Scott & Memphis R. R. 6s .	"	1928	56,426.00
8,500.00	K. C., Mem. & Birmingham R. R. 4s..	"	1934	8,287.50
37,000.00	K. C., Mem. & Birmingham R. R. 5s	"	1934	
	Kansas City Stock Yards 5s.....	"	1910	50,000.00
18,000.00	Kentucky Central Ry. Co. 4s.....	"	1987	17,910.00
3,000.00	Lake Shore & Mich. Southern 4s.....	"	1928	3,000.00
75,000.00	Lake Shore & Mich. Southern deb.4s .	"	1931	75,000.00
100,000.00	Long Island R. R. 4s.....	"	1949	96,137.50
	Mass. Elec. Co. notes 4½s.....	"	1910	24,500.00
25,000.00	Mass. Elec. Co. notes 4½s.....	"	1913	
50,000.00	N. E. Tel. & Tel. Co. 4s.....	"	1930	50,420.00
52,000.00	N. Y. C. & H. R. R. R. (L. S.) 3½s....	"	1998	46,046.65
36,000.00	N. Y. C. Equipment 5s.....	"	1919	34,740.00
31,000.00	N. Y., N. H. & H. 6s.....	"	1948	35,484.00
50,000.00	Northern Pac. Gt. Northern Joint 4s.	"	1921	48,500.00
50,000.00	Oregon R. R. & Navigation Co. 4s ...	"	1946	51,080.00
50,000.00	Oregon Short Line 4s.....	"	1929	48,500.00
2,000.00	Ozark Equipment Co. 5s.....	"	1910	4,000.00
50,000.00	Rio Grande & Western R. R. 4s.....	"	1939	49,180.00
25,000.00	Southern Ry., St. Louis Div. 4s.....	"	1951	24,875.00
5,000.00	Terminal Asso. St. Louis 4s.....	"	1953	5,000.00
50,000.00	Union Pacific R. R. 4s.....	"	1947	51,554.00
25,000.00	Wabash Equipment 4½s.....	"	1912	24,360.00
19,000.00	Wabash Equipment 4½s.....	"	1916	18,259.00
100,000.00	West End St. Ry. 4s.....	"	1917	101,470.00
28,000.00	U. S. Steel Corporation 5s.....	"	1963	
25,000.00	Western Electric Co. 5s.....	"	1922	
19,000.00	Seattle Electric Co. 5s.....	"	1929	
				$1,579,973.11

Schedule H.

REAL ESTATE MORTGAGES.

Purchases and charges during year.	*Sales and credits during year.*	*Balance at end of year.*	*Interest received.*
—	$80.00	$26,800.00	$1,300.00
—	—	104,700.00	4,200.00
—	—	25,000.00	1,000.00
—	—	30,090.00	1,190.00
—	—	4,000.00	240.00
—	191.00	48,394.00	2,150.00
—	2.00	38,094.00	1,520.00
—	222.00	50,888.00	2,500.00
—	—	49,250.00	2,000.00
—	30,227.00	—	1,050.00
—	100.00	101,000.00	5,000.00
—	10.00	17,320.00	680.00
—	—	3,000.00	120.00
—	—	119,586.25	6,000.00
—	—	6,289.21	350.00
—	357.00	56,069.00	3,000.00
—	—	8,287.50	340.00
$34,225.00	—	34,225.00	925.00
—	50,000.00	—	1,250.00
—	—	17,910.00	720.00
—	—	3,000.00	120.00
—	—	75,000.00	3,000.00
—	—	96,137.50	4,000.00
—	24,500.00	—	—
24,468.75	—	24,468.75	1,125.00
—	21.00	50,399.00	2,000.00
—	—	46,046.65	1,820.00
—	—	34,740.00	1,800.00
—	118.00	35,366.00	1,860.00
—	—	48,500.00	2,000.00
—	30.00	51,050.00	2,000.00
—	—	48,500.00	2,000.00
—	2,000.00	2,000.00	200.00
—	—	49,180.00	2,000.00
—	—	24,875.00	1,000.00
—	—	5,000.00	200.00
—	42.00	51,512.00	2,000.00
—	—	24,360.00	1,980.00
—	—	18,259.00	—
—	210.00	101,260.00	4,000.00
29,364.07	39.07	29,325.00	700.00
24,875.00	—	24,875.00	625.00
18,430.00	—	18,430.00	475.00
$131,362.82	$108,149.07	$1,603,186.86	$70,440.00

Schedule H. *Continued.*

Stocks.	*Description of Securities.*			*Balance at beginning of year.*
172	Boston & Albany R.R	par	100	$34,456.50
10	Boston Ground Rent Trust	"	100	900.00
64	Boston Real Estate Trust	"	1000	68,605.64
80	Chi., Mil. & St. Paul R.R Pf	"	100	5,738.00
2	Dwight Mfg. Co	"	500	1,600.00
27	Essex Company	"	50	3,780.00
31	Great Falls Mfg. Co	"	100	3,472.00
56	Hamilton Woolen Co	"	100	5,300.00
17	Pepperell Mfg. Co	"	100	2,789.50
				$126,731.64

INVESTMENTS W. B. ROGERS MEMORIAL FUND.

$25,000.00	Atchison, Top. & St. Fé R.R 4s ...	due	1995	$24,470.00
6,000.00	Baltimore & Ohio R.R 3½s	"	1925	5,310.00
7,000.00	Chesapeake & Ohio R.R 5s	"	1939	7,911.00
1,000.00	C., Burl. & Quincy 4% Gen'l Mtge..	"	1958	1,000.00
40,000.00	Chi. Junc. & Union S. Yds. 5s	"	1915	41,292.00
4,000.00	Cin., Ind., St. Louis & Chi. R.R. 6s	"	1920	4,000.00
37,500.00	Detroit, G. Rapids & Western R.R. 4s	"	1946	37,500.00
35,000.00	Fort St. Union Depot 4½s	"	1941	34,825.00
27,000.00	Kansas City Belt R.R 6s	"	1916	27,750.00
4,000.00	K. C., Ft. Scott & Gulf R.R. 5s ...	"	1911	4,000.00
31,000.00	N. Y. C. & H. R. R.R. deb. 4s	"	1934	30,225.00
1,000.00	N. Y. Central Equipment 5s	"	1919	965.00
3,200.00	Republican Valley R.R. 6s	"	1919	3,200.00
24,000.00	Rome, Watertown & Ogdensburg R.R. 5s	"	1922	25,560.00
1,000.00	Wabash Equipment 4½s	"	1916	961.00
				$248,969.00

INVESTMENTS JOY SCHOLARSHIP FUND.

Mass. Hospital Life Insurance Company	$5,000.00
Deposits in Savings Banks	6,397.49
	$11,397.49

INVESTMENTS SUSAN H. SWETT SCHOLARSHIP FUND.

Mass. Hospital Life Insurance Company	$10,000.00

INVESTMENTS RICHARD LEE RUSSEL FELLOWSHIP FUND.

$2,000.00 Conveyancers Title Ins. Co. Mort. 4½s, due 1913	2,000.00
Grand Total	$1,979,071.24

Schedule H. *Concluded.*

Purchases and charges during year.	*Sales and credits during year.*	*Balance at end of year.*	*Interest received.*
—	—	$34,456.50	$1,505.00
—	—	900.00	45.00
—	—	68,605.64	2,880.00
—	—	5,738.00	560.00
—	—	1,600.00	120.00
—	—	3,780.00	432.00
—	—	3,472.00	372.00
—	—	5,390.00	336.00
—	—	2,789.50	629.00
		—	*1,689.50
		$126,731.64	$8,568.50
—	—	$24,470.00	$1,000.00
—	—	5,310.00	210.00
—	$33.00	7,878.00	350.00
—	—	1,000.00	40.00
—	258.00	41,034.00	2,000.00
—	—	4,000.00	240.00
—	—	37,500.00	1,500.00
—	—	34,825.00	1,575.00
—	125.00	27,625.00	1,620.00
—	—	4,000.00	200.00
—	—	30,225.00	1,240.00
—	—	965.00	50.00
—	—	3,200.00	192.00
—	130.00	25,430.00	1,200.00
—	—	961.00	45.00
	$546.00	$248,423.00	$11,462.00
—	—	$5,000.00	$206.25
$225.80	—	6,623.29	225.80
$225.80		$11,623.29	$432.05
—	—	10,000.00	412.50
—	—	2,000.00	90.00
$131,588.62	$108,695.07	$2,001,964.79	$91,405.05

*Sale of rights N.Y., N.H. & H.

Schedule I.

INVESTMENT IN REAL ESTATE OTHER THAN EDUCATIONAL PLANT.

Description of properties.	*Balance at beginning of year. Cost.*	*Balance at end of year. Cost.*
Clarendon Street Land and Building, Grundmann Studios	$142,762.94	$142,762.94
930–934 Mass. Ave., Cambridge, Land and Buildings	16,154.38	16,154.38
Edge Hill Road (Cabot House), Land and Buildings,	18,000.00	18,000.00
	$176,917.32	$176,917.32

Schedule J.

LANDS, BUILDINGS AND EQUIPMENT.

EDUCATIONAL PLANT.*

Land and Buildings, Book Values.

Rogers Building	$200,000.00
Walker Building	150,000.00
Engineering Building A, Trinity Place	90,000.00
Engineering Building B, " "	57,357.10
Engineering Building C, " "	47,561.08
Henry L. Pierce Building " "	154,297.05
Boiler and Power House " "	26,916.74
Technology Union " "	19,460.36
Lot Number 1 " "	76,315.69
Lot Number 2 " "	137,241.60
Lot Number 3 " "	282,286.35
Electrical Engineering Building, Augustus Lowell, Clarendon St.	121,790.93
Mechanic Arts Building, Garrison St.	30,000.00
Land, Garrison St.	50,840.00
Gymnasium Building	12,624.07
Athletic Field, Brookline	112,964.32
	$1,570,155.29

Equipment, Book Values.

In Engineering Building	20,645.24
In Electrical Engineering Building	91,607.24
In Mechanical Laboratories	20,628.56
Total Educational Plant, Book Values	$1,703,036.33

*The values of land, buildings and equipment under this head are nominal values which have been carried on the books at these figures for many years. A complete appraisal of all these properties should be made and amounts closely in accord with the actual costs, or with the appraised values, should then be entered in the books.

Schedule K.

ADDITIONS TO LANDS, BUILDINGS AND EQUIPMENT.

Additions to Lands	$0.00
Additions to Equipment, Engineering Building	4,090.00
Additions to Equipment, Electrical Engineering Building	4,325.00
Total during year, per the books	$8,415.00

Schedule L.

DEPRECIATION ON LANDS, BUILDINGS AND EQUIPMENT.*

Depreciation written off to beginning of year, viz.:		
On Buildings		$
On Equipment		
		$
Appreciation of lands (if any)		
Total (net) at beginning of year		$
Depreciation written off during year, viz.:		
On Buildings	$	
On Equipment		
Total	$	
Appreciation of Lands		
Net Depreciation written off		
Depreciation written off to end of year		$

Schedule M.

NOTES PAYABLE.

	Amount.		
Notes Payable:			
Temporary loans issued	$75,000.00		
Temporary loans paid	75,000.00		
Total Notes Payable outstanding		$	0.00
Interest accrued			0.00
Total Notes Payable and Interest accrued thereon		$	0.00

*No provisions for depreciating properties have yet been established.

Schedule N.

ACCOUNTS PAYABLE.

F. E. Reed Company	$504.00
Hopkinson & Holden	281.23
Salt Lake Hardware Company	252.82
Davenport-Brown Company	190.00
William J. Reardon	157.23
Walter A. Wentworth Company	155.00
New England Telephone & Telegraph Company	142.08
James G. Biddle	137.68
Henry J. Green	119.70
Neostyle Company	113.78
99 Sundry Bills	1,880.14
	$3,933.66
Debit balance deducted	6.00
Total per balance sheet	$3,927.66

Schedule O is omitted. This schedule provides for mortgage liabilities, of which the Institute has none.

Schedule P.

ENDOWMENT FUNDS FOR GENERAL PURPOSES.

Increases and Decreases of Funds for General Purposes.

Invested Funds.	*Funds Sept. 30, 1909.*	*Income and other increases of funds.*	*Expenditure and other decreases of funds.*	*Funds Sept. 30, 1910.*
George Robert Armstrong.	$5,000.00	$241.00	$241.00	$5,000.00
Sidney Bartlett	10,000.00	482.00	482.00	10,000.00
Stanton Blake	5,000.00	241.00	241.00	5,000.00
Charles Choate	25,000.00	8,699.15	1,549.61	32,149.54
George B. Dorr	49,573.47	2,389.44	2,389.44	49,573.47
Martha Ann Edwards	30,000.00	1,446.00	1,446.00	30,000.00
James Fund	163,654.21	7,888.13	7,888.13	163,654.21
Katharine B. Lowell	5,000.00	241.00	241.00	5,000.00
Arthur T. Lyman	5,000.00	241.00	241.00	5,000.00
James McGregor	2,500.00	120.50	120.50	2,500.00
Nathaniel C. Nash	10,000.00	482.00	482.00	10,000.00
Richard Perkins	50,000.00	2,410.00	2,410.00	50,000.00
John W. and Belinda L. Randall	83,452.36	4,022.40	4,022.40	83,452.36
Robert E. Rogers	7,680.77	370.21	370.21	7,680.77
William Barton Rogers	250,225.00	11,462.00	11,462.00	250,225.00
Samuel E. Sawyer	4,764.40	229.64	229.64	4,764.40
Nathaniel Thayer	25,000.00	1,205.00	1,205.00	25,000.00
Albion K. P. Welch	5,000.00	241.00	241.00	5,000.00
Charles G. Weld	15,000.00	723.00	723.00	15,000.00
Alexander S. Wheeler	5,000.00	241.00	241.00	5,000.00
Totals	$756,850.21	$43,375.47	$36,225.93	$763,999.75

Schedule Q.

ENDOWMENT FUNDS FOR DESIGNATED PURPOSES.

Increases and Decreases of Funds for Designated Purposes.

Invested Funds.	*Funds Sept. 30, 1909.*	*Income and other increases of funds.*	*Expenditure and other decreases of funds.*	*Funds Sept. 30, 1910.*
FUNDS FOR SALARIES.				
Sarah H. Forbes For General Salaries....	$500.00	$24.10	$24.10	$500.00
George A. Gardner For General Salaries....	20,000.00	964.00	964.00	20,000.00
James Hayward Professorship of Engineering.....	18,800.00	906.16	906.16	18,800.00
William P. Mason Professorship of Geology	18,800.00	906.16	906.16	18,800.00
Henry B. Rogers General Salaries.....	25,000.00	1,205.00	1,205.00	25,000.00
Nathaniel Thayer Professorship of Physics	25,000.00	1,205.00	1,205.00	25,000.00
	$108,100.00	$5,210.42	$5,210.42	$108,100.00
FUNDS FOR SCHOLARSHIPS.				
Elisha Atkins.....	$5,018.00	$241.00	$200.00	$5,059.00
Billings Student Fund.....	50,180.00	2,410.00	2,000.00	50,590.00
Lucius Clapp.....	5,729.83	241.00	0.00	5,970.83
Dalton Graduate Chemical	5,137.37	241.00	250.00	5,128.37
Isaac W. Danforth.....	5,684.26	241.00	200.00	5,725.26
Ann White Dickinson.....	41,011.36	1,956.65	1,600.00	41,368.21
Farnsworth Scholarship ..	5,018.00	241.00	200.00	5,059.00
Charles Lewis Flint.....	5,365.51	241.00	200.00	5,406.51
T. Sterry Hunt.....	3,262.80	144.60	125.00	3,282.40
William F. Huntington....	5,303.10	241.00	200.00	5,344.10
Joy Scholarship.....	11,397.49	225.80	0.00	11,623.29
Income of Joy Scholarship	218.75	206.25	0.00	425.00
Elisha Thatcher Loring ..	5,468.79	241.00	200.00	5,509.79
James H. Mirrlees.....	2,924.40	120.50	100.00	2,944.90
Nichols Scholarship.....	5,018.00	241.00	200.00	5,059.00
Charles C. Nichols.....	5,459.29	241.00	200.00	5,500.29
John Felt Osgood.....	5,109.00	241.00	0.00	5,350.00
Richard Perkins.....	53,628.37	2,495.06	2,100.00	54,023.43
Willard B. Perkins.....	6,870.28	331.15	0.00	7,201.43
William Barton Rogers ...	11,249.59	1,374.73	1,825.00	10,799.32
Richard Lee Russel.....	2,427.17	96.40	0.00	2,523.57
Henry Saltonstall.....	10,036.00	482.00	400.00	10,118.00
James Savage.....	14,553.61	482.00	500.00	14,535.61
Thomas Sherwin.....	5,068.00	241.00	200.00	5,109.00
Susan H. Swett.....	10,620.45	412.50	400.00	10,632.95
Susan Upham.....	1,306.28	48.20	50.00	1,304.48
Ann White Vose.....	61,214.27	2,907.10	2,400.00	61,721.37
Newsboys Fund.....	0.00	100.00	0.00	100.00
	$344,280.17	$16,684.94	$13,550.00	$347,415.11
Less Gifts, Transfers, etc...		932.50		
Net increase per Schedule R.		$15,752.44		

FUNDS FOR LIBRARIES AND READING ROOM.				
Charles Lewis Flint	$5,000.00	$241.00	$241.00	$5,000.00
Wm. Hall Kerr	2,000.00	96.40	96.40	2,000.00
Arthur Rotch Architectural Library	5,000.00	241.00	241.00	5,000.00
Ednah Dow Cheney for Margaret Cheney Reading Room	14,292.37	674.80	558.89	14,408.28
	$26,292.37	$1,253.20	$1,173.29	$26,408.28
FUNDS FOR PRIZES.				
Arthur Rotch Prize Fund in Architecture	$5,218.00	$241.00	$400.00	$5,059.00
Arthur Rotch "Special" PrizeFundinArchitecture	5,418.00	241.00	300.00	5,359.00
	$10,636.00	$482.00	$700.00	$10,418.00
OTHER FUNDS.				
Whitney Fund	$0.00	*$25,000.00	$0.00	$25,000.00
Edward Austin Fund	360,000.00	17,352.00	*17,352.00	360,000.00
Edward Austin (income reserve)	14,449.60	*1,735.20	0.00	16,184.80
Bursar's Fund	6,169.73	* 321.97	150.29	6,341.41
Susan E. Dorr	20,288.48	*1,977.90	977.90	21,288.48
Improvement Fund (reported separately).				
Charlotte Billings Richardson (Industrial Chemistry)	37,378.78	1,801.66	*1,801.66	37,378.78
Arthur Rotch Architectural Fund	25,000.00	1,205.00	1,205.00	25,000.00
The Saltonstall Fund	43,567.47	2,099.96	1,574.97	44,092.46
Teachers' Fund	100,000.00	4,820.00	*4,820.00	100,000.00
	$606,854.06	$56,313.69	$27,881.82	$635,285.93
*Less gifts, transfers, etc		27,760.45	23,372.00	
Income for year, for "other funds"		$28,553.24	$4,509.82	

Recapitulation of Funds.

SPECIAL FUNDS	*At Beginning.*	*Income.*	*Outgo.*	*At End.*
Funds for Salaries	$108,100.00	$5,210.42	$5,210.42	$108,100.00
Funds for Scholarships	344,280.17	15,752.44	13,550.00	347,415.11
Funds for Libraries and Reading Room	26,292.37	1,253.20	1,137.29	26,408.28
Funds for Prizes	10,636.00	482.00	700.00	10,418.00
Other Funds	606,854.06	28,553.24	4,509.82	635,285.93
Total Special Funds	$1,096,162.60	$51,251.30		$1,127,627.32
GENERAL FUNDS.				
Funds for General Purposes	$756,850.21	$36,325.93	$36,225.93	$763,999.75
TOTAL INCOME per Schedule B–1		$87,477.23	$61,333.46	
Gifts,transfers and refunds		35,842.49	23,372.00	
GRAND TOTALS	$1,853,012.81	$123,319.72	$84,705.46	$1,891,627.07

Schedule R.

INCREASES AND DECREASES OF MINOR CASH FUNDS.

	Funds Sept. 30, 1909.	*Income and other increases of funds.*	*Expenditure and other decreases of funds.*	*Funds Sept. 30, 1910.*
MINOR CASH FUNDS.				
Applied Chemistry	$66.72	$4,846.70	$3,881.46	$1,031.96
Samuel Cabot Medal Fund.	99.62	0.00	61.72	37.90
Dormitory Fund	1,868.96	0.00	0.00	1,868.96
Jacques Fund	0.00	1,496.71	0.00	1,496.71
Letter Box Fund	5.25	22.75	4.25	23.75
M. I. T. Alumni Fund	3,811.41	40,644.15	44,455.56	0.00
Naval Architectural Fund (Weld)	0.00	8,000.00	7,741.96	258.04
President's Fund	0.00	1,500.00	232.16	1,267.84
Research Laboratory of Organic Chemistry	0.00	300.00	0.00	300.00
Roentgen Ray Experiment Fund	880.44	0.00	16.00	864.44
Sanitary Research Fund	1.91	5,635.25	5,494.72	142.44
Seismological Research Fund	0.00	3,200.00	2,120.69	1,079.31
Travelling Scholarships in Architecture	750.00	500.00	1,250.00	0.00
	$7,484.31			$8,371.35
Physico-Chemical Research Fund	*69.77	4,635.70	4,791.60	*225.67
	$7,414.54	$70,781.26	$70,050.12	$8,145.68

* Debit balance.

FUNDS' INCOME.				
Cash Accumulations:				
Edward Austin Fund Income	$5,969.50	$17,352.00	$4,252.88	$7,728.42
Teachers' Fund Income	16,380.00	4,820.00	1,647.49	19,552.51
	$22,349.50	$22,172.00	$5,900.37	$27,280.93

Schedule S.

SURPLUS ACCOUNTS.

CURRENT SURPLUS.

Balance October 1, 1909		$233,833.14
Net reduction for the year (Schedule A)		23,598.87
		$210,234.27
Portion of Alumni Fund expended for equipment of laboratories		8,415.00
Balance Spetember 30, 1910 (per Schedule D)		$201,819.27

EDUCATIONAL PLANT ENDOWMENTS, ETC.

Balance October 1, 1909		$1,694,621.33
Increase by expenditure of Alumni Fund		8,415.00
Balance Spetember 30, 1910		$1,703,036.33

REPORT OF AUDITING COMMITTEE.

BOSTON, Dec. 6, 1910.

To the Corporation of the
Massachusetts Institute of Technology:—

Your auditing committee report that Messrs. Harvey S. Chase & Company, certified public accountants employed by this committee, have examined the accounts of the Treasurer of the MASSACHUSETTS INSTITUTE OF TECHNOLOGY for the year ended September 30, 1910, and have verified the cash at office and in banks and that their certificate is hereto annexed.

We have verified the list of securities held by the Institute.

CHARLES C. JACKSON,
JAMES P. TOLMAN,
WILLIAM L. PUTNAM,
} *Auditing Committee.*

AUDITORS' CERTIFICATE.

84 STATE STREET, BOSTON, Dec. 6, 1910.

To the Auditing Committee of the
Massachusetts Institute of Technology:—

WE HEREBY CERTIFY that we have examined the books and have audited the accounts of the treasurer and of the bursar of the Massachusetts Institute of Technology for the fiscal year ended September 30, 1910. We have established the assets and liabilities of the Institute as set forth on the balance sheet included in our report to the treasurer, and have brought the ledger accounts into agreement therewith. We have found the books in excellent condition, and they have been accurately kept during the year. We have verified the vouchers for disbursements and have satisfied ourselves that all receipts of money had been acknowledged on the books and deposited in the banks, that the cash balances of the books on September 30, 1910, were actually available and that these balances were correct. We have verified the details of the bookkeeping during the year, have rearranged the methods of accounting in various respects and have prepared the report of the treasurer upon schedules submitted herewith.

Very respectfully,

HARVEY S. CHASE & COMPANY,
Certified Public Accountants.